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Rocky Mountain Front

Montana Department of Fish, Wildlife & Parks

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June 1984

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Montana Mountain Goat Investigations
Rocky Mountain Front

Prepared by:
Gayle Joslin
Wildlife Division
Montana Department of Fish, Wildlife and Parks
In Cooperation With
Lewis and Clark National Forest
USDA Forest Service

June 1984

ABSTRACT

Management recommendations, based on the attached mountain goat seasonal habitat maps and the endorsed Interagency Rocky Mountain Front Wildlife Guidelines, involve seasonal restrictions on human activities within mountain goat habitat. Thirty-three and three mountain goats have been captured and marked from the Blackleaf and Our Lake mineral licks, respectively since 1979. Collective home ranges of males are 50.2 percent larger in summer and 47.7 percent larger in winter than those of females. Ranges of males are 9.4 percent larger and females are 4.7 percent larger in summer than in winter. Females are more faithful to their home ranges than are males based on average distances between yearly geographic activity centers. Individual home range sizes varied from 16 square km for an adult female to 178 square km for an adult male. Male home ranges may overlap more than those of females. Approximately 23 percent of the study area is used by the 23 radio-marked goats captured at the Blackleaf mineral lick. As of May 1984, 10 radio collars are functioning on mountain goats. Association tests between all combinations of 2 radio-marked goats revealed that 75 percent of all female-to-female associations were in the range of 2 to 6 km while 70 percent of the male-to-male associations were greater than 6 km. Eighty-nine percent of all associations in the 0 to 2 km range involved juvenile goats. The study area is divided into 3 major segments within which 8 known and 2 potential population centers exist. Based on 8-9 helicopter surveys, the population trend in the north and center segments appear to be stable. Status of the southern segment is uncertain. Although drawbacks to using a Lincoln-Peterson Index were demonstrated, a liberal population estimate for the center Teton-Dupuyer segment varies from 95 to 157 mountain goats. Of the 6 marked goats which died since 1979, 2 were avalanche victims, 2 were hunter kills and 2 were possible poaching mortalities. At least 5 kids of radio-marked females died since 1980. Only 1 of 4 adult radio-marked females raised a kid in 1983. Discriminant analysis of 4 environmental variables revealed that slope and elevation are the most important factors to mountain goats in selecting seasonal habitat, followed by aspect and distance to the nearest driveable road. All types of seasonal habitats generally occur on slopes of 70 percent or greater and at elevations of 1829 meters or above. Fifteen mineral licks were recorded. Seven months of food habits information from feeding site exams and fecal analysis indicate similar results in rank order of shrubs, grass and forbs during late winter and spring, then the order shifts to forbs, grass and shrubs through the summer.

Energy exploration activity amounted to 115, 28 and 188 miles of seismic lines being tested within mountain goat habitat during 1981, 1982 and 1983, respectively. Other human activities within the study area are addressed including livestock grazing, fire control, road and trail management and hunting. The current hunting permit levels in hunting districts 414 and 415 occur within the 4 to 7 percent range of the estimated population which

is generally used in establishing hunting seasons on mountain goats. Information collected over the course of this project has been used to develop the mountain goat portion of the Rocky Mountain Front Interagency Wildlife Guidelines.

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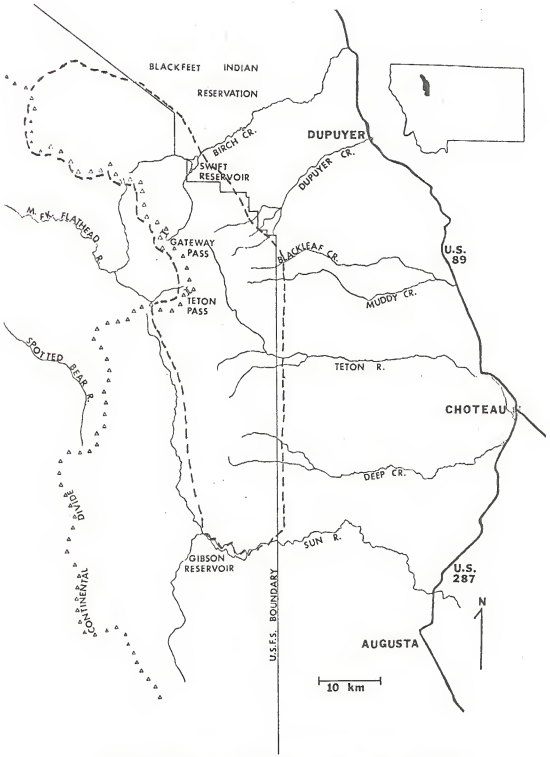

Rocky Mountain Front mountain goat study area.

INTRODUCTION

Montana maintains one of the largest populations of mountain goats in North America. Over 95 percent of mountain goat habitat in the state occurs on lands administered by the U. S. Forest Service. Interest in the development of natural resources on National Forest land is intensifying, and with the development come associated increases in human activity. Mountain goat research in North America has demonstrated that this species is particularly vulnerable to activities of man. Locally, their populations have declined or disappeared in areas of Montana, Idaho, South Dakota, Alaska, British Columbia and Alberta due to mining (Brandborg 1955, Pendergast and Bindernagle 1975), logging and road access (Chadwick 1973, Joslin 1980, Phelps et al. 1975, Kerr 1965, McFetridge 1977, Merriam 1965, Ballard 1977, Alaska Department of Fish and Game 1975 and 1976, Schoen and Kirchoff 1981) and recreation (L. Rice, pers. comm., South Dakota Department of Game, Fish and Parks).

The East Front of Montana's Rocky Mountains provides habitat for one of the largest contiguous populations of mountain goats in the state. This area has recently experienced a surge of oil and gas exploration activity, as well as impacts from other commodity extraction and recreational demands. The majority of activity has occurred along the East Front of the Sawtooth Range, an area rich in wildlife diversity and abundance. In an attempt to avoid or minimize negative impacts from energy exploration and other disturbance, state and federal agencies and private organizations felt it necessary to initiate intensive work along the East Front to gather information about wildlife population status, habitat use and response to human activities. During the past few years, research on the East Front has been initiated on mountain goats, grizzly and black bears, bighorn sheep, elk, mule deer and raptors.

Mountain goats are native to the East Front. The first investigations of this population were conducted by the Montana Department of Fish and Game (MDFG) from 1946 to 1948 (Casebeer et al. 1950). Aside from occasional aerial surveys by the MDFG, no other study of this population was conducted until 1978, when a graduate thesis (Thompson 1980) was initiated to provide an update to the early 1950's information. A brief follow-up to this endeavor was conducted by Tomasko (1980). The study area and scope of study were expanded in 1981 to provide information for the entire East Front and to monitor the response of mountain goats to energy exploration.

The goal of the East Front mountain goat investigation is to ensure the continued survival of a healthy, viable mountain goat population from the Sun River to Badger Creek while industry and recreation take place in the same country. The East Front Interagency Executive and Technical Committees were in part established to pursue this goal.

This project has been conducted under the auspices of the Rocky Mountain Front Interagency Executive Committee with cooperative funding from the Montana Department of Fish, Wildlife and Parks and the Lewis and Clark National Forest (USDA Forest Service contract no. 53-0398-3LE-63).

In order to develop the recommendations needed by both wildlife and land managers to minimize human disturbance to mountain goats and their habitat along the East Front, the objectives of the project are to:

1. delineate individual population segments of the East Front mountain goat population,

2. determine the population status, trend and distribution of each segment,

3. determine seasonal ranges including kidding-nursery, breeding and yearlong habitats and mineral lick sites, and

4. monitor population parameters and habitat use between segments and through time in order to detect changes in response to human activity.

This report combines information from previous reports (Joslin 1981, 1982, 1983), data collected through winter 1983-84 and incorporates computer analysis of collective and individual home ranges and preferential habitat selection. It also summarizes and augments management guidelines which have been endorsed by the Interagency Executive Committee (1984).

STUDY AREA

The Sawtooth Range of northcentral Montana extends from the Canadian border through Glacier National Park to the Dearborn River. The eastern portion of this range is known as the East Front since faults and thrusting of sedimentary rocks have created north-south mountain reefs which rise abruptly from the prairies and line up in parallel ranks back to the Continental Divide. The East Front mountain goat study area occupies approximately 12,432 square kilometers (480 square miles) in the center one-third of the Sawtooth Range. The study area was divided into three segments based on physiography and mountain goat distribution. The northern segment encompasses an area of approximately 432 square kilometers (170 square miles) drained by Birch, Badger and Two Medicine creeks. The center Teton-Dupuyer segment covers approximately 380 square kilometers (150 square miles) and is drained by the Teton River and Dupuyer Creek. The southern segment includes the 400 square kilometers (160 square miles) east of the North Fork of the Sun River, which is drained by the Sun River, Deep and Willow creeks.

Most of the study area occurs on land administered by the Lewis and Clark National Forest. Minor amounts occur on Bureau of Land Management, Blackfoot Indian Reservation, Flathead National Forest and private lands.

The highest point on the study area is Rocky Mountain at 2863 meters (9392 feet), which lies at the head of the South Fork Teton. The study area boundary, as outlined in the study area map, is defined roughly by the 1830 meter (6000 feet) level.

Precipitation ranges from 38 cm (15 in) on the eastern prairie border to over 200 cm (80 in) in the alpine where 60 to 80 percent falls as snow. Weather data from east, north and south of the study area at Blackleaf, East Glacier and Gibson Dam reporting stations (National Oceanic and Atmospheric Administration 1983) are presented in Appendices 1 and 2.

Vegetation structure of the East Front is complex. Rough fescue (Festuca scabrella)/Idaho fescue (Festuca idahoensis) grassland at the eastern edge of the study area merges with open stands of limber pine (Pinus flexilus)/shrubby cinquefoil (Potentilla fruticosa) in the foothills. The limber pine grades into thicker stands of mixed Douglas fir (Pseudotsuga mensiezii), limber pine, Englemann spruce (Picea engelmannii), and lodgepole pine (Pinus contorta) at the base of the reefs and on the reef plateaus.

As successive sets of cliff and plateau stair-step upward, the mixed conifer forest gives way to parkland composed of scattered limber and/or whitebark pine (Pinus albicaulis) (depending on soil type), spruce, sub-alpine fir (Abies lasiocarpa) and Douglas fir. Above the parkland timber, subalpine fir and whitebark pine are relegated to dwarfed, stunted krummholz forms which ultimately are replaced on more severe sites by frost-churned rocky soil, termed "crust," which supports intermittent colonies of primarily mat-forming subshrubs and forbs. Short grass meadows and shrub stands compose the remaining vegetation structures occasionally found throughout the study area.

Detailed descriptions of vegetation, habitat types and land types occurring on the study area are described in Harvey (1980), Thompson (1980), Holdorf (1981) and Holdorf et. al. (1980). Much of the area falls within designated wilderness areas which were mapped using land type associations (USDA Forest Service 1976) rather than the more specific land types used on National Forest lands outside classified wilderness.

Fifteen land type associations and 21 land types were noted on a subsample of the study area, but with regard to mountain goat use, land type association VI and land types 202, 182 and 171 appear to be most commonly used. Land type association VI describe peaks and alpine ridges which are sparsely vegetated rockland, in a high precipitation zone, with low fuel accumulation and a long recovery time (Holdorf et al. 1980). Land type 202 is described as very steep (60 percent) limestone

rockland and scree on fault escarpments or glacial cirque headwalls. Active gravitational movement of loose rock and soil are common. On most areas active avalanche chutes are common. This land type normally supports open growing stands of Douglas fir, subalpine fir, spruce and whitebark pine on forested scree (Holdorf 1981). Land type 182 is composed of a complex of rock outcrop and talus (75 percent) and stable soils (25 percent) on very steep (60 percent) slopes underlain by limestone. The stable soils are deep, well drained, calcareous soils forming in very gravelly colluvium. Vegetation is principally Douglas fir or limber pine forest on scree (Holdorf 1981). Land type 171 is a complex of lodgepole pine forest (75 percent) and fescue grassland (25 percent) on steep (40-60 percent) glacially scoured slopes. This type is of minor extent on the Rocky Mountain Front (Holdorf 1981).

METHODS

Trapping and Marking

A 12.2 x 18.3 m (40 x 60 ft) cannon net was used to capture mountain goats at the Blackleaf mineral lick. The site was monitored from July 10 to September 3, 1981, and from June 19 to July 15, 1982. Captured goats were marked with metal ear tags and plastic PVC pipe radio collars, elastic expandable radio collars or color coded canvas neckbands. Frequencies of radio collars ranged from 150.000 to 151.999 MH_z. The sex and age of each animal were determined. If circumstances permitted, measurements were taken on neck girth, body length, shoulder height, chest girth, rostrum length, beard length, ear length and horn lengths and circumferences. The horns of captured goats were usually capped with rubber hose to prevent injury to other goats and goat handlers. Animals were generally blindfolded, which appeared to reduce struggling. Ten to 20 minutes were required to process one individual (not including time to untangle goat from net). Several animals "played dead" when released, which seems to be capture behavior common to mountain goats.

Monitoring

Radio marked goats were generally relocated from a Supercub twice per month using a Telonics TR-2 receiver/scanner and a rotating three element Yagi antenna mounted on the belly of the aircraft. Ground tracking was conducted only when an animal was suspected of being dead, using the Telonics receiver and a collapsible hand-held two element Yagi antenna.

Helicopter surveys were conducted over portions of the East Front during July or August from 1979 to 1983, and winter surveys were conducted in 1979, 1980, 1981, 1982 and 1984. Most surveys were done in a Bell 47 G3B helicopter. Mountain goats were classified as adults, two-year olds, yearlings, kids and males and females, if possible. Occasionally it was not possible to obtain specific

classifications, in which case adults, subadult, nonkid and unclassified categories were used.

Date, drainage, location (UTM), classification and environmental information for each observation or radio relocation were recorded and entered on a computerized observation form (Appendix 3 and 4).

Population Analysis

Home range information including area, geographic activity center (GAC), number of fixes and standard diameter for individual and collective home ranges were calculated using the Telday program (Lonner and Burkhalter 1984) on the Montana State University (MSU) Honeywell computer. Associations between individuals were also calculated using Telday. Population centers were determined from survey information and radio relocation information where females, subadults and/or kids were consistently observed. Population trend information was based on annual surveys and comparisons to historical information. Population estimates were based on a known marked sample of mountain goats occurring in the population and subsequently observing a percentage of that sample during surveys. Radio collars and neckbands on adult animals were used for this purpose but elastic expandable collars fitted on kids, yearlings and 2-year olds could not be observed from the air.

Habitat Analysis

Categories of environmental information collected for each radio relocation or observation are described in Appendix 4. Vegetation structure and land type were described previously under Study Area. Terrain types define the physiography of a site. The primary feature of the following four terrain types is rock: cliffs and cirque basins - rock faces several meters in height; bluffs - benches with rock drop-offs, often in step-like formation; talus - masses of shale or boulders; broken - areas which are not cliffs, bluffs or talus, but are difficult to traverse due to rocky ground. These types provided maximum security for goats from predators. If an area could not be defined by one of the rocky terrain types, then it was classified as one of the four remaining types including: ridge - the line of land separating two drainages; creekbottom - bottom of a drainage or line of land where opposing sidehills meet; park - a nontimbered flat or sloping area; sidehill - a catch-all term used to categorize any nonrocky area which would not fit any of the other terrain types.

The percentage occurrence of various slopes (in percent), slope exposures (aspect), elevations, land types, burns (to the nearest decade) and grazing occurrence (cattle or sheep) was tested for a 646 square km subsample of the study area (52 percent). This information was derived from 1463 random points distributed over

the subsample and analyzed as part of the East Front grizzly bear project (Aune et al. 1984 and Marcum and Loftsgaarden 1980).

A base map of the East Front study area was digitized using the Department of Fish, Wildlife and Parks Research Lab Discovery computer. Map information for the study area includes political boundaries, 89 drainages, 49 peaks, 18 roads and 36 trails open to some form of motorized transportation, 10 Forest Service cabins, and 9 lakes or reservoirs.

Seasonal Habitat Use

The following describes the basis for development of mountain goat habitat maps which are the foundation of the management guidelines. The variables analyzed for frequency of occurrence in the environment were also summarized from each observation record or radio-relocation record to determine frequency of use. Discriminant analysis using the SPSS (Nie et al. 1975) program was applied to several of these variables to determine which are actually influencing habitat selection by mountain goats. These results, based on 2237 mountain goat records (more than one goat observation may be involved in a record), were used to develop mountain goat habitat maps of the East Front. Occupied yearlong mountain goat habitat included both summer and winter seasons. The winter period is considered to occur from October 15 to May 15. Also included in Occupied yearlong habitat are kidding-nursery and breeding areas which occur from May 1 to July 15 and from November 1 to December 31, respectively. Suitable low occupancy habitat met all of the defined environmental criteria for Occupied habitat but mountain goat observations for these areas have not been recorded. Transitional habitat involves those areas through which mountain goats travel, generally during the periods October 15 to December 31 and May 1 to June 30.

Food Habits

From March through September 1981, efforts were made to observe foraging mountain goats in order to locate five feeding sites per month. After hiking to specific sites, a feeding site exam was conducted, which consisted of laying out 15-2X5 decimeter frames at 2 meter intervals along the approximate course which the feeding goat followed, then recording the relative canopy coverage of all vegetation species occurring in the frames.

Plants which could not be identified in the field were collected, labeled, pressed and then identified at a later date. All specimens were either verified or identified using Hitchcock and Cronquist (1973) by G. Moore and P. Lesica, botanists, University of Montana. Plants that appeared to have been fed upon at each site were noted. The more obvious species that occurred on the site but did not occur in the sample frames were also noted. Frequency of occurrence and average cover of each species at each

site were calculated, then the five sites were combined for a monthly total of average frequency and cover.

Five mountain goat pellet group samples were collected per month from March through September, and along with vegetation samples were sent to W. Kasworm for identification of vegetation in fecal samples using microhistological methods (Kasworm 1982).

RESULTS AND DISCUSSION

Population Dynamics

Trapping and Marking

One and 23 mountain goats, respectively, captured at the Our Lake and Blackleaf mineral licks were fitted with radio collars. A brief history of all marked mountain goats is presented in Appendix 5. Body measurement of 11 captured goats are presented in Appendix 6. Figure 1 shows all relocations of 23 radio-marked mountain goats along the East Front while Figures 2 through 5 present all records of mountain goats from 1941 to 1984.

Collective Home Ranges

The yearlong summer and winter collective home ranges for all male and female mountain goats captured at the Blackleaf mineral lick are shown in Figure 6. The collective home range size (Table 1) of both males and females was 300.8 square km. Collective summer ranges were larger than winter ranges and collective home ranges of males were larger than those of females. The males' summer and winter ranges were 50.2 percent and 47.7 percent larger than those of females', respectively. Males reduced their home range size during winter by 9.4 percent while females reduced theirs by only 4.7 percent.

Table 1. Collective home range sizes of twenty-three radio-marked mountain goats which use the Teton-Dupuyer portion of the study area.

Group Composition (N)	Home Range (square km)	No of Fixes	Standard Diameter (km)
Summer - All years - 5/1 to 9/30			
Females (12)	135.6	278	7.5
Males (11)	272.6	274	12.6
All Goats (23)	287.0	552	10.6
Winter - All years - 10/1 to 4/30			
Females (12)	129.3	225	9.0
Males (11)	247.0	276	12.7
All Goats (23)	264.1	501	11.3
Yearlong - All years			
All Goats (23)	300.8	1053	11.0

Comparing the summer range of each sex to the combined summer range of both sexes, males used 95 percent of the area while females used only 47.1 percent. Therefore, 5 percent of the collective summer range was used by females exclusively while 52.9 percent was used by males exclusively. Comparing the winter range of each sex to the combined winter range of both sexes, males used 93.5 percent of the area while females used only 49 percent. Therefore, 6.5 percent of the collective winter range was used exclusively by females while 51 percent was used exclusively by males.

The geographic activity centers (GAC) for all of the collective home ranges occurred between the South Fork of Dupuyer and Muddy Creek. The most northerly GAC was the males' summer range in Rival Creek, while the females' winter range was the most southerly in the head of Muddy Creek.

As the standard diameter indicates, two-thirds of all relocations (1053) occurred within 11 km of the yearlong GAC (Table 1). While the standard diameters of the male summer and winter home ranges were nearly the same, the females appeared to either move greater distances or distributed themselves farther apart in winter than in summer. Approximately 24 percent of the study area (1243 square km) was used by these 23 mountain goats.

Individual Home Ranges

Individual home range polygons and geographic activity centers for 24 radio-marked mountain goats are shown in Figures 7 through 23. Table 2 shows the yearlong home range size of each radio-marked mountain goat. Comparing animals for which at least one year of information was available, the largest home range was 178.08 square km for an adult male while the smallest was 16.0 square km for an adult female. Only one male had a home range smaller than the average for females while all females were smaller than the average for males.

Comparing individual home range sizes with the respective sexes collective summer home range size, females averaged 76.3 percent smaller and males averaged 70.6 percent smaller, possibly indicating more overlap in male home ranges.

The average distance between GAC's indicates that females are more faithful to a given area than are males. Averaging the mean distance between GAC's of the 4 adult females having 3 or more GAC's the mean drops from 1.1. to 0.93, indicating that more information provides a better representation of home range fidelity. However, the adult male which had 5 GAC's had by far the largest mean distance between GAC's.

In subadults also, the males tended to have larger home ranges than females. Two subadults had 2 GAC's each. The mean distance between GAC's for the subadult female was double the average for adult females while that of the subadult male was nearly 3 times

the average for adult males. This tends to substantiate the fact that, as for other species, subadult mountain goats are prone to wandering.

Table 2. Home range information for twenty-four radio marked mountain goats.

ID No.	# Fixes	$\bar{x}$ Dist. between Fixes (km)	Area (Sq km)	GACS	$\bar{x}$ Dist. between GACS (km)
Adult Females					
1172	102	2.72	44.29	4	0.49
0529	66	2.75	34.9	3	0.56
0829	52	2.57	38.97	3	1.94
2220	55	1.89	47.38	3	0.73
2302	47	1.77	24.08	2	0.87
2402	47	1.81	27.49	2	0.72
2902	46	2.58	16.00	2	2.19
8141	32	3.09	24.39	1	-
4922*	8	2.71	13.72	1	-
Average	56	2.40	32.19		1.1 .93(4)
Adult Males					
7239	58	5.75	53.48	2	1.14
1859	114	5.26	178.08	5	4.33
2692	50	1.75	22.68	2	0.88
1802	47	3.33	62.58	2	1.69
6982	47	4.74	134.07	2	2.06
8612	47	4.96	53.67	2	0.15
3402	47	4.78	81.62	2	1.58
7082	44	3.21	84.43	2	0.63
7881	24	4.73	50.75	2	3.8
Average	53	4.28	80.15		1.8
Subadults					
0131 M[1/]	45	3.34	39.23	2	5.3
5902 M	26	2.95	30.67	1	-
4301* F	46	2.49	37.67	2	2.01
9121* F	9	2.17	10.34	1	-
5261 F	10	4.6	21.56	1	-
5302 F	38	1.93	13.51	1	-
Average	39	2.68	30.27		

*Not included in average
1/ Denotes male (M) or female (F)

ASSOCIATIONS

The association of any 2 mountain goats was determined by measuring the distances between 2 individuals on a given day and averaging all distances. This provided an index of association which could be compared with any other group of 2 mountain goats. Twenty-three mountain goats captured from the Blackleaf lick site provide 253 theoretical association possibilities. Some transmitters or animals died before other transmitters were put in the field, and only those associations in which a minimum of 4 or more fixes occurred were used, so comparing two goats at a time a total of 204 combinations were possible.

The greatest mean distance between 2 goats was 14.5 km and involved a 1-2 year old male and an adult female. The closest mean distance between 2 goats was 0 km (observed together) and involved a 4-5 year old male and a 2-3 year old female. Table 3 shows the breakdown of the 204 association possibilities. Most female to female (adult) associations were in the range of 2 to 6 km (75 percent). None occurred at closer than 2 km or over 10 km. The majority of adult males (70 percent) spaced themselves at average distances of greater than 6 km while 30 percent occurred between 2 and 6 km, but none was closer than 2 km. Adult male to adult female spacing was generally between 4 and 10 km (74 percent) but 15 percent occurred between 0 and 4 km while 11 percent occurred at over 10 km. While 71 percent of the juvenile to other goat associations were between 2 and 8 km, 89 percent of all associations in the 0 to 2 km category involved juvenile goats.

Table 3. Association results in percent: distance between any two mountain goats.

KM[1]	0-2	2-4	4-6	6-8	8-10	OVER 10
N=204 pairs[2]	9	38	57	51	33	16
F-F[3] (20)[4]	-	50	25	20	5	-
M-F(53)	2	13	25	30	19	11
M-M(30)	-	7	23	33	27	10
Juv-Other(101)	8	19	31	21	14	7

[1] Mean distance between mountain goats in 2 km increments

[2] Twenty-three marked mountain goats consisting of 7 adult females (30%), 9 adult males (39%), and 7 juveniles (2 years or less) (30%), totalling 204 pairs.

[3] Pair categories: F-F = female to female, M-F = male to female, M-M = male to male, Juv-Other = Juvenile (kid, yearling or 2 year old) to any other goat

[4] Number of pairs of mountain goats occurring in this category

Between certain individuals or groups there does appear to be some association but it is difficult to tell what constitutes an association by choice or one of home range proximity. Those between an adult and a juvenile can be presumed to be one of need on the part of the juvenile, but the reasons behind associations between adults are not as clear.

The rank of association from most to least closely associated, in general appears to be: females to females, juveniles to other goats, males to females, and males to males.

Population Centers

Eight known and two potential mountain goat population centers exist along the East Front. A population center is based on observations of female-subadult groups and radio relocations. Two, five and one population centers occur in the Birch-Badger, Teton-Dupuyer and Deep-Sun areas, respectively. The two population centers in the Birch-Badger area include: 1. Goat Mountain, Running Owl Mountain and Bullshoe Mountain; 2. the peaks separating Birch from Badger Creeks including Family Peak, Mount Poia, Scarface Mountain, Morningstar Mountain, Spotted Eagle Mountain and Curly Bear Mountain. A potential population center exists in the Mount Baldy, Kiyo Crag, Half Dome Crag vicinity since goats have been harvested there. The five population centers in the Teton-Dupuyer area include: 1. Middle and South Forks of Birch Creek including Bum Shot Mountain, Crooked Mountain, Mount Drewyer, Mount Sentinel, Mount Richmond and Mount Field; 2. Mount Wright along Corrugate Ridge to Patrick Gass and east to the North Fork of the Teton; 3. the reefs along the eastern edge of the Front from Walling Reef to Choteau Mountain and west to the North Fork of the Teton; 4. Mount Lockhardt, Teton Peak, Nesbit Creek area; 5. Old Baldy, Rocky Mountain area. The latter two population centers may actually be one but additional information is necessary in the Teton Peak area to make that determination. The one population center in the Deep-Sun area involves Ear Mountain, North Fork Deep Creek and No Business Creek. The Castle Reef-Arsenic Mountain area is known to have supported mountain goats in the past at the heads of the creeks and along the ridges running north from the Sun River. This area should be considered a potential population center.

Population Trends

Although information has been collected on the East Front mountain goat population since 1978, the helicopter surveys conducted in July 1979 and August 1980 can not be compared to the surveys done after 1980, since the same areas were not covered, classification schemes differed, and observers changed.

Birch Creek-Badger Creek Area

Four intensive helicopter surveys and three spot checks of this area were made from 1979 through 1984. The March 1981, July 1982

and July 1983 surveys (Appendix 7, 10, 11, 13, 14, and 15) were most similar in that 70, 78 and 80 mountain goats were observed, respectively. Kid:adult ratios were 0.35 in March 1981, 0.43 in July 1982 and 0.45 in July 1983; while subadult: adult ratios were 0.16, 0.16 and 0.36, respectively. During other surveys the following numbers of goats were observed: 3 in July 1979, 2 in March 1980, 42 in July 1981 (Appendix 8 and 13), 14 in April 1982 (appendix 9 and 14). Inconsistency in weather, flight paths, observers and funding are responsible for variability in these results.

Teton River-Dupuyer Creek Area

Nine intensive helicopter surveys (Appendix 7, 8, 10-16) and one spot check of this area have been made during the course of this study (Table 4). Twenty-three goats were observed during the April 1982 spot check (Appendix 9 and 14). Kid:adult ratios were quite similar during the July 1981 and 1982 surveys. Kid:adult ratios were 0.29, 0.23 and 0.12, respectively, while subadult:adult ratios were 0.27, 0.29 and 0.19, respectively. Detailed classification information was not collected during previous surveys, therefore, kid:nonkid ratios only are available.

Early distribution records for this area indicate that goats were observed in areas which are not often used now. Corrugate Ridge, Washboard Reef and Teton Peak are a few such areas. In addition, several goats were observed on Mount Wright where only an occasional recent observation has been recorded.

Sun River-Deep Creek Area

Four intensive helicopter surveys and three spot checks of this area have been conducted over the course of the study. Intensive surveys covered all drainages and most of the topographic relief within each drainage. During these surveys, 29 mountain goats were observed in March 1981 (Appendix 7 and 13), 2 in July 1981, (Appendix 8 and 13), 35 in July 1982 (Appendix 10 and 14) and 20 in July 1983 (Appendix 11 and 15). During spot checks, 7 mountain goats were observed in July 1979, 0 in March 1980 and 11 in April 1982 (Appendix 9 and 14). March 1981 kid:adult and subadult:adult ratios were 0.25 and 0.1, respectively. July 1982 ratios were 0.24 and 0.43, respectively. July 1983 ratios were 0.15 and 0.38, respectively. The inconsistency in flight results, aside from the factors previously mentioned, may be a function of the narrow canyons in Deep Creek which are difficult to access.

Although consistent yearly surveys necessary to determine population trends have not been conducted, the relative population level, compared to the 1940's and 1950's, is down. Data are inadequate to indicate the current population trend in this area. Past records report 115 mountain goats were observed in the Deep Creek and South Fork Teton vicinity (Goers and

Table 4. Nine mountain goat helicopter surveys conducted from the North Fork Dupuyer to South Fork Teton portion of the East Front during winter and summer, 1979 to 1984.

Survey Date	Total	Kid: Adult	Subad: Adult	Kid: Non kid	Male: Female	# Marked Goats OBS	Min # Marked Goats in Field	Max # Marked Goats in Field	Range Estimated % of Pop Observed
3/79	49								
7/79	66			.29					
3/80	53			.18					
8/80	73			.43					
3/81	86	.36	.20	.30					
7/81	89	.30	.28	.23					
7/82	79	.23	.29	.23	.52	10	12	17	59-83
7/83	75	.12	.19	.10	.41	7	16	22	32-44
4/84	60	.13	.20	.11	.48	8	13	21	38-61

Brandborg 1955) and, on a single occasion in 1941, 31 mountain goats were seen at the Deep Creek lick site (Cooney 1942). Mountain goat distribution also appears to have become more restricted in this area in recent years. Past records indicate that goats have been observed or killed in the following locations: Grouse Creek, Bridge Creek, Arsenic Mountain, Big George Gulch, Mortimer Gulch and Hannon Gulch. These areas have all been surveyed during this study, but mountain goats have not been observed.

Population Estimates

Population estimates can be accurately made only if an adequate segment of the population is marked and can subsequently be observed in the population (Rice and Harder 1977). If those animals which have been marked develop avoidance reactions to aircraft, then the marked segment is no longer functional in providing population estimates. This type of avoidance behavior may be occurring in the marked segment of the population. No marked mountain goats occurred in the Birch-Badger or Deep-Sun portions of the study area.

Sixteen of 17 marked goats were known to be present in the Teton-Dupuyer area during the July 1983 survey. Seven of these were observed during the survey, resulting in an apparent efficiency of 44 percent. However, of the 16 marked animals present, 8 were females and 8 were males, but 6 females (75 percent) were observed while only 1 male (12.5 percent) was observed. It might be speculated that the males are merely more difficult to see since they are often solitary at this time of year and that they may be using more heavily vegetated habitat types. While both of these assumptions appear to be true for males, the observation data does not bear out the hypothesis that only 12 percent of the males were observed. Of the three areas surveyed, the Teton-Dupuyer area appeared to have the highest male:female ratio (41:100). If the observability percentages between males (12.5) and females (75) are applied to the number of animals actually observed, the male:female ratio would be 218 males per 100 females. This was probably not the case. The winter 1984 survey also supported the conclusion that males are less observable than females and that marked males are probably less likely to be seen than unmarked males. During this survey, of the 8 marked mountain goats observed 4 were females and 4 were males but 5 marked females and 8 marked males were known to be in the field, so the interpretation is that 80 percent of the females and 50 percent of the males were observed. The observed male:female ratio was 48:100 but interpretation of the marked sample suggests a ratio of 77:100. Again it appears that the marked males were more adept at avoiding observation. This bias limits application of a Lincoln-Peterson Index (Rice and Harder 1977).

If an observation index is applied, minimum population estimates range from 95 to 170 mountain goats in the Teton-Dupuyer area

while maximum estimates range from 133 to 234. The high minimum and maximum both occurred during the July 1983 survey.

Weather is known to influence observability of mountain goats (Fox 1983), and it is thought that the July 1983 survey may have been affected by the late timing of the survey and weather. During the second half of the survey the weather became hot and sultry. The area covered during this hot period involved the marked sample. At least partly in response to weather conditions, several goats (primarily males) moved into heavy timber and creekbottoms. This was confirmed by a radio-relocation flight conducted between survey flights.

If the estimates from the July 1983 flight are deleted, the population estimate for the Teton-Dupuyer area occurs in the range of 95 to 157 mountain goats. If marked goats are indeed less observable than unmarked mountain goats, then population estimates should be considered liberal.

Mortality

Six collared mountain goats including 4 radio-marked and 2 neckbanded animals are known to have died over the course of the study. A 3 year old male and a 3 year old female were taken during the hunting season. A yearling male and 6+ year old female apparently were killed in avalanches. A 10 year old male and 5 year old female either died of natural causes or were illegally shot. The collar, hair and bone fragments of a 10 year old male were found near the Cave Mountain campground. The collar and carcass of a 5 year old female were located within 200 meters of a well used trail which crosses the Blackleaf lick. The proximity of both carcasses to areas heavily used by people supports the possibility of poaching.

At least 5 kids of radio-marked females died during the course of the study, including 2 in 1980, 1 in 1981 and 2 in 1982. In 1983 all 4 radio-marked females were of kid bearing age, but only one managed to raise a kid until the winter of 1984 when the mother was killed in an avalanche. The fate of her kid is not known. It was not determined whether the other females bore kids which died shortly after birth, but none of them were observed in the company of a kid up to May 1984.

Survival of yearlings may be almost as poor as that of kids (Chadwick 1983). Since yearlings and 2 year olds are grouped as subadults, it is difficult to trace the mortality in a given cohort. If the decrease from the kid:adult ratio to the next years subadult:adult ratio is doubled to allow for grouping of subadult age classes, the kid losses over the past 3 years is generally less than 10 percent, which is low for mountain goats.

Kid mortality has been estimated from 15 to 80 percent (Hibbs 1966, Holroyd 1967, Rideout 1978, Stevens and Driver 1978). Yearling mortality estimates range from 2 to 59 percent (Holroyd

1967, Rideout 1974, Chadwick 1977). Adams and Bailey (1982) used 6 percent mortality in adults to simulate population growth. Population dynamics analysis for segments of the East Front mountain goat population will be addressed in the future using the POSIM program (Mooney and Lonner 1978).

The 1983 kid:adult and subadult:adult ratios for the Teton-Dupuyer area were lower than they had been in recent years. These ratios for the Teton-Dupuyer area were slightly lower than the Deep-Sun area ratios and they were distinctly lower than the Birch-Badger area ratios. It is possible that the viral-pneumonia disease (Pasturella hemolytica) which plagued the bighorn sheep may have been a factor in low ratios in this area since the timing of the disease was synonymous with the drop in ratios. A dead mountain goat was found in the South Fork of the Teton area (T. Bivins, pers. comm.) and had been suffering from pneumonia, although not Pasturella.

Habitat Use

Seasonal Habitat Selection

Analysis of seasonal habitat selection was based on a total of 2239 mountain goat observation records. Complete environmental information for each record could not always be obtained. Land types, terrain types and vegetation types were more frequently determined for each record than aspect, elevation and slope since the latter require precise locations, while the former cover general areas.

In order to obtain an indication of mountain goat preference of various environmental features, availability of each must be determined. A frequency analysis of 5 environmental variables was determined on 1463 random points distributed over a sample portion of the study area (Table 5). Similar frequency analysis were completed on 153, 266 and 2237 records of mountain goat observations during the kidding-nursery period (Table 6), breeding period (Table 7) and the combined summer and winter periods (yearlong habitat) (Table 8), respectively. The five variables included slope, elevation, aspect, distance to nearest driveable road and land type.

Discriminant analysis was performed on the first four variables to determine which are important to mountain goats in selecting seasonal and yearlong habitat. For all three tests (kidding-nursery, breeding and yearlong) the most important variable was slope followed by elevation. The third most important variable in selection of kidding-nursery and yearlong habitat was distance to the nearest driveable road, while aspect was the third variable in selection of breeding habitat.

Slopes greater than 70 percent account for less than 20 percent of the available habitat (Table 5), but more than 75 percent of the mountain goat observations during all 3 seasonal periods

Table 5. Frequency distribution of habitat parameters existing within a portion of the East Front mountain goat study area, based on 1463 random points

Elevation	- %
5000-5500	3.1
5500-6000	12.4
6000-6500	26.9
6500-7000	23.5
7000-7500	22.4
7500-8000	9.1
8000-8500	2.1
8500-9000	0.5

Aspect	- %
N	10.8
NE	13.1
E	15.7
SE	13.7
S	8.0
SW	13.9
W	16.1
NW	8.8

Slope	- %
90± %	3.3
70-89	15.4
30-69	66.2
10-29	12.0
0-9	3.0

Distance to Road	- %
Less than ¼ mile	5.8
¼ - ½ mile	6.1
½ - 1 mile	10.6
Over 1 mile	77.5

Land Type Code	%	Code	%	Code	%
12	.4	72	.1	III	1.9
13A	.2	160	.2	IIIa	.4
14D	1.3	161	.9	IV	.1
18	3.2	171	.9	Va	1.1
20	.2	181	1.7	Vb	2.1
21A	1.4	182	7.2	Vc	2.8
22	1.6	183	.3	Vd	1.7
23A	.4	200	1.1	Ve	29.4
25	4.8	202	12.6	VI	.1
25B	.1	I	.2	VII	4.7
25C	1.2	Ib	.6	VIIa	.8
71	6.9	II	.6	VIII	6.7

Table 6. Frequency distribution of habitat parameters on the East Front used by mountain goats during the kidding-nursery period, based on 153 observation points.

Elevation	- %
6000-6500	11.0
6500-7000	14.0
7000-7500	44.1
7500-8000	27.9
8000-8500	2.9

Aspect	- %
N	8.7
NE	5.8
E	43.5
SE	10.1
S	10.1
SW	3.6
W	7.2
NW	5.8
Flat	5.1

Land Type Code	%
71	1.4
161	.7
171	12.8
182	.7
202	64.5
VI	19.9

Slope	- %
± 90 %	26.3
70-89	58.4
30-69	9.5
10-29	3.6
0-9	2.2

Distance to Road	- %
Less than ¼ mile	4.3
¼ - ½ mile	-
½ - 1 mile	2.6
Over 1 mile	93.1

Table 7. Frequency distribution of habitat parameters on the East Front used by mountain goats during the breeding period, based on 266 observation points.

Elevation	%
5500-6000	.9
6000-6500	5.1
6500-7000	11.2
7000-7500	42.3
7500-8000	32.6
8000-8500	7.0
8500-9000	.9

Aspect	%
N	7.2
NE	13.9
E	32.5
SE	19.1
S	7.7
SW	5.7
W	5.7
NW	7.2
Flat	1.0

Land Type Code	%
30	.4
71	.8
171	1.6
181	.4
182	13.3
202	64.3
VI	19.2

Slope	%
± 90 %	39.9
70-89	38.4
30-69	20.7
10-29	1.0
0-9	-

Distance to Road	%
Less than ¼ mile	.7
¼ - ½ mile	2.2
½ - 1 mile	2.2
Over 1 mile	94.8

Table 8. Frequency distribution of habitat parameters on the East Front used by mountain goats yearlong, based on 2237 observation points.

Elevation	%
4000-5000	.1
5000-5500	.2
5500-6000	.8
6000-6500	9.3
6500-7000	14.9
7000-7500	35.3
7500-8000	30.1
8000-8500	8.0
8500-9000	1.2
9000-9500	.2

Aspect	%
N	9.4
NE	14.4
E	31.0
SE	13.7
S	9.7
SW	7.7
W	6.7
NW	4.6
Flat	2.9

Land Type Code	%
18	1.0
23	.01
25	.1
25A	.01
30	.01
61	.01
63B	.1
66	.01
71	.6
161	.1
171	5.0
181	.4
182	6.0
183	.4
200	.01
201	.01
202	57.1
203	.01
Va	.01
Vd	.01
VI	27.8
VII	.8

Slope	%
± 90 %	31.2
70-89	44.6
30-69	19.9
10-29	1.4
0-9	2.9

Distance to Road	%
Less than ¼ mile	2.2
¼ - ½ mile	1.1
½ - 1 mile	3.4
Over 1 mile	93.4

(Tables 6, 7 and 8) occurred on slopes of 70 percent or greated. Elevations over 2134 meters (7000 feet) account for less than 35 percent of the available habitat but 75, 83 and 75 percent of the kidding-nursery, breeding and yearlong mountain goat observation records, respectively, occurred at elevations of 2134 m and above. Aspects between northeast and southeast account for about 42 percent of the available habitat but 59, 65 and 59 percent of the kidding-nursery, breeding and yearlong mountain goat observation records, respectively. About 77 percent of the sampled area occurred at distances of over 1.6 km (1 mile) from a road while at least 93 percent of the mountain goat observations during all 3 seasonal periods occurred at distances of over 1.6 km.

Seasonal Distribution

Over 2200 observation records of mountain goats were used to develop seasonal range use maps (Figures 24 through 44). The study area boundary, outlined on the distribution maps, describes the area which is annually surveyed. Within this area, all country above 1829 m (6000 ft) occurring on slopes of 70 percent or greater are classified as occupied (number 1 on maps) or suitable (number 2 on maps) use areas based on habitat selection data described previously. There is little definable difference between summer and winter habitat selection, so these seasons were combined. Known kidding-nursery areas are identified with a dotted line in Figures 24 through 44. Kidding-nursery areas are noted on the map if a solitary female was observed during May or June or if a group of goats which contained a kid was observed during June, July or August. Known breeding areas are identified with a dashed line in Figures 24 through 44. All observations of adult (2½ years of age and older) males and females during November and December were used to delineate breeding areas.

Summer and Winter Areas

Summer and winter habitat is essentially the same, so it is called yearlong habitat. Yearlong habitat occurs at elevations ranging from less than 1524 m (5000 ft) to over 2743 m (9000 ft) and on all aspects and slopes within the study area. Generally mountain goats are observed between 1829 m and 2590 m (6000-8500 ft), on north, east and south exposures, on slopes greater than 30 percent and on land types 202, IV, 182 and 171. In summer mountain goats can be seen on all vegetation and terrain types, but in winter they tend to occur on crust, forest and parkland vegetation types and cliff, talus and ridge terrain types.

Kidding-Nursery Areas

Kidding-nursery areas occur on all aspects and slopes and most elevations within the study area. Generally, they occur on east to southeast exposures on slopes of 70 percent or greater; between 1829-2438 m (6000-8000 ft) elevation; on land types 202, VI, 171 and 182; in all terrain types and on the crust, forest, parkland, short grass and brush vegetation types.

Breeding Areas

Breeding areas occur on all aspects and elevations within the study area but tend to occur on eastern exposures; on slopes of 70 percent and greater; at elevations of 2134-2438 m (7000-8000 ft); on land types, 202, VI, and 182; on cliff and bluff terrain types; and crust, forest, parkland and krummholz vegetation types.

Mineral Licks

Fifteen mineral licks are known to occur within the study area (Figures 31, 35, 36, 37, 39, 41, 42 and 44). The Curly Bear, Walling Reef, Old Man of the Hills, Nesbit Creek and Headquarters Pass licks may be natural mineral licks, but the other 10 are artificially established sites. The Blackleaf, South Fork Dupuyer, Walling Reef, Old Man of the Hills, Nesbit Creek, Our Lake, Headquarters Pass, North Fork Deep Creek and Frenchy Gulch sites are regularly used by goats. The South Fork Deep Creek lick is occasionally used. The degree of use of the Curly Bear, Blindhorse, Walling-Split Mountain, Chute Mountain and Erosion Gulch licks receive is not known.

Mountain goats will use salt during all months of the year (DeBock 1970). Males tend to use licks during May, June and early July. Females generally do not begin using licks until after the kids are born in June, but they continue to use them into September.

In using licks, most ungulates are seeking sodium bicarbonate (Stockstad 1953 and Smith 1954). Hebert and Cowan (1971) indicate that there is a sodium imbalance in the diet of mountain goats during spring since the diet has shifted from dry winter forage to lush green forage which tends to flush the system of essential nutrients.

The mountain goats' desire for salt is strong and will lead them into unsafe surroundings out of normal mountain goat habitat, away from escape terrain. These circumstances will develop if artificial lick sites are established near the fringes of mountain goat habitat. Rideout (1974) hypothesizes that mountain goats will risk predation to satisfy their drive and need for salt. Singer (1978) documented numerous mountain goat vehicle incidents in Glacier Park along Highway 2 where goats were trying to cross the highway to use a salt lick.

Food Habits and Feeding Site Analysis

Preliminary food habits information was collected from 34 feeding sites in the Teton-Dupuyer area from March through September 1981 (Appendix 17). Frequency of occurrence and average cover of nine general ground cover categories and all plant species are summarized for each month and presented in Appendix 18 and 19,

respectively. A total of 5 genera of species of trees, 21 species of shrubs, 176 species of forbs and 30 species of grasses and grass-like plants were recorded on all feeding sites. The months having the highest average cover of shrubs, grass and forbs were April, June and September, respectively. March had the highest average cover of rock and snow.

Plant frequency was closely correlated with average cover during June, July, August and September. Forbs, grass and shrubs ranked first, second and third in both frequency of occurrence and average cover during these months. During March, April and May, the category which ranked first in frequency did not rank first in average cover. This may have been a function of classifying some plants, particularly penstemons, as forbs rather than shrubs.

Appendix 20 lists 78 genera or species which were noted to have been grazed upon at sampled mountain goat feeding sites. Mountain goats may not have fed upon all the species noted, since mule deer and bighorn sheep were also occasionally observed feeding in the same areas as mountain goats.

In order to quantify diet preferences of mountain goats, it is necessary to determine plant species availability in comparison to actual use. Although the feeding site data presented in Appendix 19 is a step in that direction, the data were insufficient to quantify individual plant species availability throughout seasonal mountain goat habitat.

Comparison of grass, forbs and shrubs (Table 9) reveal that these broad forage classes tend to occur in the same relative order in fecal samples (Table 10) and on feeding sites (Appendix 18). For five of the seven months in which samples were collected and exams were conducted, the first and third categories coincided, indicating a correlation between availability and forage selection. The conclusion from this would be that goats feed on whatever is available, but this may not be true, since those sites selected by goats for feeding may not be typical of the environment as a whole. If mountain goats do selectively feed, then the discrimination occurs when they select the site on which to feed, rather than choosing between available forage classes at a particular location.

More detailed comparisons show that 41 of the 46 items (89 percent) which occurred in the fecal samples also appeared on feeding sites (Appendix 19 and 21) while 41 of the 121 genera which were known to occur on feeding sites also occurred in fecal samples. Seventy-five species, involving 52 genera, were noted to have been fed upon at feeding sites; of these, 21 or 40 percent were noted in fecal samples.

Over the seven month sample period, an average of 81 percent (63-89 percent) of the top ten genera which occurred in fecal samples (Appendix 22) occurred at feeding sites. Again, this

Table 9. Ranking of relative abundance of grass, forbs and shrubs on monthly mountain goat feeding sites as compared to relative abundance of grass, forbs and shrubs in monthly mountain goat fecal samples.

	March	April	May	June	July	August	Sept
Grass	3/1 [1/]	2/2	2/2	2/1	2/2	3/2	2/2
Forbs	2/3	3/3	3/3	1/2	1/1	1/1	1/1
Shrubs	1/2	1/1	1/1	3/3	3/3	2/3	3/3

1/ Feeding sites/fecal samples. Five feeding sites and five fecal groups were sampled and averaged each month.

Table 10. Percentage of grass, forbs and shrubs in the diet of mountain goats from March through September 1981, as determined by microhistological analysis of fecal samples.

	Grass	Forbs	Shrubs
March	39.2	22.2	38.6
April	41.0	15.4	44.0
May	40.4	12.4	47.2
June	59.2	24.4	16.0
July	25.0	55.8	19.4
Aug	34.8	54.4	11.0
Sept	35.2	39.0	25.6

would indicate that goats are feeding upon species which are available. However, if the most common species at feeding sites are compared with the most abundant species in fecal samples, the correlation is less than 50 percent, suggesting selection for some species at certain times.

Although feeding site exams provide detailed descriptions of areas where mountain goats were observed to feed, collection of pellet groups is a more efficient and less biased method of assessing food habits since they represent all habitats and all time periods in which goats fed.

The bioenergetics of other species of ungulates reveal that in order to conserve energy in winter, involuntary weight loss occurs regardless of the quantity of food available. Mountain goats too, have been noted to lose weight during winter (Casebeer et al. 1950). This appears to be an adaptation for winter survival in that less food is required to maintain a smaller body mass. In addition, ungulates also adjust their behavior in winter to minimize energy expenditure in daily activities. Mackie et al. (1980) explains that the basal metabolic rate of deer drops along with body mass and, that it is actually a combination of the animal's physiological condition upon entering winter and numerous environmental conditions (beyond simple winter forage condition) which determine winter survival. Thus, a given herd's survival strategy is determined by a specific combination of energy conservation measures and the particular habitat in which it lives. The objective in collecting food habits information has evolved from analysis of winter range condition as an index of habitat carrying capacity to research of the physiology of an animal in concert with its particular habitat or survival strategy.

Human Activities

Timber Management, Livestock Grazing, Fire History, Roads and Trails

National Forest lands support a variety of uses, many of which occur on the East Front. The type and extent of past timber harvest in mountain goat habitat on the study area has yet to be addressed. A frequency analysis was run on a subsample (about 52 percent) of the study area to determine the proportion of the area receiving livestock grazing. About 20 and 10 percent of the sample area sustained cattle and sheep grazing, respectively. The same sample area was tested for fire occurrence on a 10 year basis. Approximately 79 percent of the sample area has not been burned within the past 100 years. Twelve percent had been burned prior to 1910, while 8.5 percent of the sample area has burned since that time. Eighteen roads and 36 trails which receive some type of motorized use during at least a portion of the year exist within the study area. Figure 45 illustrates their distribution.

Oil and Gas Exploration

Oil and gas exploration and development have recently become a major land use activity on the East Front. The Proposed Lewis and Clark National Forest Plan (1982) states that, "development for natural gas and other minerals is likely to occur on the Forest ... wildlife and semi-primitive recreation settings will be impacted the most." In order to assess the current and future response of mountain goats to this activity, a base of information is being gathered concerning the intensity, extent and duration of oil and gas exploration and development along the East Front.

Exploration activities employ a number of methods including surface charges, portable drilling, deep shot holes, vibroseis and magneto-tellurics - each of which requires a series of support activities implemented by individual crews. Energy exploration information is available from Forest Service records (Rocky Mountain Ranger District) for 1981, 1982, and 1983. Five companies involved in exploration during 1981 began work in mid July and continued beyond October. Within mountain goat range, over 115 miles of seismic lines were permitted and most of these were tested. Several important mountain goat use areas were crossed within the following drainages: North Fork Badger, Lonesome, Limestone, North Fork Birch, Steep, Small, North and South Forks Dupuyer, Sheep, Blackleaf, Muddy, Blindhorse, Chicken Coulee, Claree Coulee, Jones, Massey, North Fork Teton, Middle Fork Teton, South Fork Teton, North Fork Deep, Sheep, Slim, Billie, South Fork Deep, No Business, Sun River, Hannon, Blacktail and Big George. During 1982, 8 companies involved in seismic exploration activities tested about 17 of 28 permitted miles of lines from mid June through October within mountain goat range. Mountain goat use areas within the following drainages were involved: North Fork Badger, Scoffin Creek, North Fork Teton, North Fork Deep, Sheep, Slim, Billie, Sun River. In 1983, 4 companies involved in seismic exploration tested 188 miles of line within mountain goat habitat from June through October. Mountain goat use areas within the following drainages were involved: South Fork Two Medicine, North Fork Badger, Kip, Lee, South Fork Badger, Lonesome, Limestone, Lookout, North Fork Birch, North and South Fork Dupuyer, Washout, Blackleaf, Cow, Muddy, Blindhorse, Jones, Massey, North, Middle and South Forks of the Teton, South Fork Willow, Slim, Sheep, Green Timber, Hannon, Blacktail, Mortimer, Big George and Arsenic.

As far as actual response to seismic lines, it was found that when a line was set up in the Blackleaf canyon, four radio marked goats in that drainage moved into adjacent drainages even before the blasting occurred. Similarly on Walling Reef (T. Andryk, pers. comm.), four adult goats, as well as a band of sheep, all left the area of a seismic test within 24 hours after the blasting. Immediate responses to actual blasting range from no apparent change in activity to leaping out of their beds and running in confusion. Considering the regular occurrence of

electrical storms, avalanches and falling boulders in mountain goat terrain, the presence of people is probably more disturbing than seismic blasts. All phases of seismic activity must abide by restrictions in seasonally sensitive areas in order for the management guidelines to be effective. Ultimately we must gain an understanding of how reproductive performance, habitat use and population stability are affected by energy activity.

The apparent nonchalant attitude of mountain goats is a crucial feature of their adaptive strategy since they cannot afford to panic in dangerously steep terrain. Physiological changes typical of stress no doubt occur in mountain goats as they do in other species of ungulates when something out of the ordinary occurs. These changes generally include increased hormone levels (Thompson 1957, Denenberg and Rosenberg 1967), raised heart rates (MacArthur et al. 1979) and respiration, as well as increased metabolic levels (Webster and Blaxter 1966 and Blaxter 1962 in Geist 1978). The consequences of chronic stress are insidious and difficult to document. They may show up as reduced feeding time (Kiley 1974), yet when under stress there is an increased need even for basal metabolic rates (Geist 1978), plus the additional needs of the active inhibition period. In addition, there may be increased fetal abortion and resorption (Geist 1971), reduced reproduction (Reid and Miles 1962 in Geist 1978), avoidance of certain areas resulting in loss of access to resources and, ultimately, reduced population (Batcheler 1968 in Geist 1978).

To avoid or minimize possible adverse consequences of energy exploration activities upon mountain goats, strict adherence to the management guidelines is necessary. These guidelines are based on knowledge of mountain goat movement patterns, home range sizes, mortality causes and behavioral traits.

Since mountain goats are extremely methodical in the use of their range and are reluctant to move or change their habits, exposure to human activities are likely to be manifest internally where the field biologist cannot document the effects of that exposure except through monitoring of population dynamics.

Hunting

Mountain goat hunting seasons in Montana date back to 1872 when the territorial legislature banned hunting from February 1 to August 15 of each year. In 1895 the legislature created a Board of Game Commissioners who established an annual mountain goat bag limit of eight. The hunting season at that time was from September 15 to December 31. The bag limit was reduced to one goat in 1905. By 1935 a statewide closure on mountain goat hunting was in effect. Not until 1955 was a season on mountain goats along the Rocky Mountain Front reestablished, but this time it was under a permit system (Table 11).

Table 11. Mountain goat harvest on the East Front, 1955-1983.

Year	Hunting District	No. Permits	Season Dates	Harvest Male	Female	Total
1955	313[2]	5	9/15-11/15			
	314[3]	5	9/15-11/15			4
1956	314[3]	20	9/15-11/15			15
1957	414	20	9/15-11/24			12
1958	414[4]	40	9/15-11/30			21
1959	414[4]	40	9/15-11/22			19
1960	414	60	9/15-11/20			40
1961	414	80	9/15-11/19			45
1962	414	80	10/ 7-11/25			55
1963	414	80	9/15-11/24			46
1964	414	80	10/18-11/22			48
1965	414	80	9/15-11/22			41
1966	414	80	9/15-11/27			31
1967	414	80	9/15-11/26			43
1968	414	100	9/15-12/15			45
1969	414[5]	100	9/15-12/14	25	16	41
1970	414[5]	75	9/15-11/29	15	14	29
	415[6]	50	9/15-12/14	15	11	26
1971	414	50	9/15-11/28	10	1	11
	415	50	9/15-11/28	8	5	13
1972	414	25	9/15-11/26	2	0	2
	415	50	9/15-11/26	10	4	14
1973	414	10	9/15-11/25	2	0	2
	415	25	9/15-11/25	4	2	6
1974	414	No season				
	415	10	9/15-11/24	1	0	1
1975	414	No season				
	415	5	9/15-11/23	3	0	3
1976	414	No season				
	415	5	9/15-11/28			0
1977	414	No season				
	415	5	9/15-11/27	2	2	4
1978	414	5	9/15-11/26	1	1	2
	415	10	9/15-11/26	1	1	2
1979	414	5	9/15-11/25	1	3	4
	415	10	9/15-11/25	4	0	4
1980	414	5	9/15-11/30	1	3	4
	415	5	9/15-11/30	0	2	2
1981	414	5	9/15-11/29	2	1	3
	415	5	9/15-11/29	1	2	3
1982	414	5	9/15-11/28	4	2	6
	415	5	9/15-11/28	1	2	3
1983	414	5	9/15-11/27	1	3	4
	415	3	9/15-11/27	1	0	1

1 - Hunting district (HD) 313=Route Cr, M Fk Teton south, including Lewis & Clark National Forest in Teton Co.

2 - HD 314=north of 313 in Lewis & Clark National Forest to Birch Cr

3 - Teton County within Lewis & Clark National Forest

4 - HD 414=open to Highway 2 on national forest land east of Continental Divide

5 - HD 414=south & east of Teton Pass down Trail 114 to road then east to national forest boundary then north to N Fk Dupuyer Cr then west up trail 724 to and along trail 125 (no longer numbered) to S Fk Birch Cr to its head at Continental Divide then south along divide to Teton Pass

6 - HD 415=north of HD 414 to Highway 2

Over the years hunting district boundaries and numbers of permits fluctuated throughout the state in response to demand and wildlife management philosophies which advocated harvest pressure to stimulate herd production (Figure 45). Management of the East Front population reflected mountain goat management throughout the state (Figure 46), but in both cases the desired population response was not achieved and eventually permits were reduced to accommodate decreasing herds.

A more conservative management approach toward mountain goats has emerged and so has the need for determining the status, trend and distribution of individual population segments. On the East Front at least 3 segments of the population have been identified as well as the relative population level of each. Distribution of each segment is being determined, as are population trends.

Population information for the Teton-Dupuyer area indicates that the 5 permits which are currently allowed in hunting district 414 fall within the range of 4 percent (Kuck 1977), 5 percent (Hall 1977), to 7 percent (Adams and Bailey 1982). The estimated mountain goat population is between 95 and 155 for hunting district 414 (see Population Estimate section). Ballard (1977) indicates that 10 percent of the observed number of mountain goats is used to establish permit levels in Alaska, however this method was developed for heavily timbered country and may be liberal in the Birch-Badger country. Eighty-four mountain goats were observed in the Birch-Badger portion of the study area but only 55 occurred within hunting district 415.

That portion of the East Front mountain goat herd which is not hunted, particularly the Deep Creek-Sun River segment, has demonstrated a vulnerability to people in the past. Although this herd appears to be slowly increasing since transplanting and hunting ceased 10 years ago, its distribution has been altered and its ability to provide recreational opportunities has been severely limited. New pressures in the form of energy exploration and development, livestock grazing or other human activities could once again retard or reverse population growth.

Reducing hunting seasons is not an equitable or acceptable method of compensating for impacts created by other human activities. If the management guidelines developed for the East Front are rigorously followed, and mountain goat herds still decline, then hunting seasons must be reevaluated.

Establishment of conscientious hunting seasons requires knowledge of a herd's natural mortality, productivity and recruitment as well as hunter woulding losses, percentage of permit holders who participate in the hunt and hunter success. Management of game animals theoretically strives to limit hunter take to somewhat less than the net annual gain in population. If other human activities are taking a toll on population numbers through mortality, decreased productivity or habitat alteration, then they too must be taken into account when hunting seasons are

established. Proliferating road access is the primary problem which wildlife managers face when developments encroach into mountain goat country. The kind and degree of effect a road may have on a particular goat herd must be determined. In the past, mountain goats probably suffered less from poaching than most other species since road access into goat terrain was limited. Now that roads are penetrating their habitat, goats may be more prone to poaching losses since their structured, predictable behavior dictates use of traditional areas regardless of the presence of a road.

Management Recommendations

The ultimate goal of the East Front mountain goat investigation is to ensure the continued survival of a healthy, viable mountain goat population from the Sun River to Badger Creek while industry and recreation take place in the same country. The East Front Interagency Committee was in part established to pursue this goal. The committee consists of representatives from the Lewis and Clark National Forest, Bureau of Land Management, U. S. Fish and Wildlife Service, and the Montana Department of Fish, Wildlife and Parks. In April 1984 the Committee endorsed the Rocky Mountain Front Wildlife Guidelines (Appendix 23) which provide management direction for human activities in mountain goat habitat as well as in grizzly bear, raptor, elk, mule deer and bighorn sheep habitat.

The recommendations provided here are the culmination of 5 years of study on the East Front mountain goat population. These recommendations reiterate and augment the endorsed mountain goat guidelines.

Mountain Goat Seasonal Use Areas

Criteria used in delineating seasonal use areas are described in Results and Discussion under Seasonal Distribution. The terms occupied, suitable and transitional habitat describe specific areas within which human activities are managed under guidelines tailored to maintain the habitat requirements of mountain goats in that area. These guidelines include timing of use and certain activity restrictions. The area from the Sun River north along the North Fork Sun and Continental Divide to the Badger-Two Medicine Divide then south along the prairie-reef zone at the east edge of the East Front is defined by a heavy black line which delineates mountain goat habitat. The relative use of this area by mountain goats is indicated by areas identified as Occupied Yearlong Habitat (number 1), Suitable Low Occupancy Habitat (number 2) and Transitional habitat (number 3) in Figures 24 through 44. Occupied yearlong habitat is the heart of mountain goat habitat on the East Front. It is used yearlong by mountain goats and contains all known kidding-nursery areas and breeding areas. Suitable low occupancy habitat possesses all the environmental features of Occupied habitat, but mountain goats have not been observed in these areas. Transitional habitat, by

virtue of its juxtaposition with the Occupied and Suitable areas, is used by goats primarily for travel, although some mineral licks do occur there. Mountain goat seasonal habitat delineations should be incorporated into the data base of the Lewis and Clark National Forest for use in Forest planning.

Kidding-Nursery

Those areas in which a lone adult female was recorded during May or June, and those areas in which a kid of the year was observed during June, July, or August constitute known kidding-nursery areas. These areas are identified with a dotted line in Figures 24 through 44. Descriptions of environmental features used by mountain goats meeting the above criteria were discussed previously (see Seasonal Distribution, Kidding-Nursery Areas). In all cases, known kidding-nursery areas occur in Occupied yearlong habitat. Timing restrictions for human activities in kidding-nursery areas occur from May 1 to July 15.

Breeding

Those areas known to be used by adult mountain goats during the November-December breeding period are identified with a dashed line in Figures 24 through 44. Descriptions of environmental features used by mountain goats at this time were discussed previously (see Seasonal Distribution, Breeding Areas). In all cases, known breeding areas occur in Occupied yearlong habitat. Timing restrictions for breeding areas occur from November 1 to December 31.

Mineral Licks

Fifteen identified mineral licks occur within East Front mountain goat habitat. Eleven of these occur in occupied yearlong habitat (Figures 31, 35, 36, 41, 42, and 44), three occur in transitional habitat (Figure 37 and 39) and one falls outside the mountain goat habitat boundary (Figure 35). The importance of mineral licks to mountain goats and the role they play in placing mountain goats in vulnerable situations away from escape terrain was discussed previously. For these reasons, establishment of new mineral licks within mountain goat habitat should be done only after determining whether the proposed lick site would make mountain goats vulnerable to people or predators and whether its placement would pull livestock into areas of goat use during phenologically sensitive periods (May and June). The following guidelines are recommended for management of mineral licks:

1) a no surface occupancy stipulation should be placed on energy and mineral exploration and development and timber harvest within a 0.8 km (0.5 mi) radius of mineral licks,
2) new mineral licks within mountain goat habitat should not be established without considering the safety of goats,

3) limit livestock use of mineral licks to after July 1, or stagger allotment use so that adjacent licks are not used simultaneously,
4) establish helicopter flight patterns at least 1.5 km (1 mi) from mineral licks and during the May 1-July 31 period,
5) restrict use of roads and trails which come to within 0.8 km (0.5 mi) of a lick to nonmotorized use during the May 1 to July 31 period, and
6) the road crossing the Blackleaf lick should be relocated.

Occupied Yearlong Habitat

Occupied yearlong habitat (number 1) is vitally important to the well-being of mountain goat herds along the East Front. Mountain goats have been observed in these areas over the years during winter and/or summer. Environmental features used by mountain goats during summer and winter were discussed previously (see Seasonal Distribution, Summer and Winter Areas) and do not differ significantly from season to season. Therefore, areas in which goats were observed during summer were considered winter use areas as well, and vice versa. Particularly during mild years, mountain goats appear to travel their range almost as extensively as during summer. Since mountain goats use number 1 areas yearlong, the following guidelines are recommended:

1) restrict activities in winter range from October 15 to May 15,
2) obliterate and reclaim existing roads where access cannot be effectively controlled,
3) limit seismic operations to methods which can be accomplished in the least amount of time and with minimal disturbance,
4) maintain helicopter flight distances at a minimum of 200 m (600 ft) from all ground surfaces (canyon walls included),
5) restrict helicopter flight paths to corridors of maximum 0.8 km (0.5 mi) in width (or less if necessary to accommodate minimum flight heights),
6) land types typical of occupied habitat are generally poor timber producers, timber harvest should not be allowed,
7) restrict livestock grazing to the period from July 1 to October 15,
8) do not use heavy equipment for fire suppression, if access is created to control fire, reclaim all roads and trails,
9) wildlife habitat manipulation should not occur unless a program satisfactory to the needs of all species whose habitat is involved is endorsed by the Montana Department of Fish, Wildlife and Parks, and
10) emphasize nonmotorized recreation.

Suitable Low Occupancy Habitat

Suitable low occupancy habitat (number 2) has all of the physical characteristics of occupied yearlong habitat and are probably important mountain goat habitat, but observations of goats have not been recorded for these areas. Surveys of suitable mountain goat habitat must be made to determine whether goats are present prior to initiation of a planned activity. If goat use is documented, the stratification will be changed to Occupied yearlong mountain goat habitat and the listed guidelines will apply. If mountain goat use is not documented, then guidelines listed for Transitional habitat will apply.

Transitional Habitat

Transitional habitat (number 3) is used by mountain goats primarily during peak movement periods such as spring and fall, but they do not generally provide the environmental characteristics which goats seek. Terrain typical of Transitional Habitat generally has slope inclinations of less than 70 percent and/or elevations of less than 1830 m (6000 ft). Land types on Transitional Habitat usually have more soil accumulation and greater vegetation growth potential than those of occupied or suitable habitat. Creeks typically flow through the center of transitional habitat. The following guidelines are recommended for management of transitional habitat:

1) limit timber harvest, road construction, oil and gas or hard rock mineral exploration and development, to the period July 1 to October 15 and January 1 to April 30 (exclusive of spring transition and breeding movements), and
2) restrict helicopter flight paths to water courses.

Human Activities

Facilities

Since proliferation of road access has led to mountain goat declines in Montana (Joslin 1980), British Columbia (Phelps et al. 1975), Idaho (Brandborg 1955), Alberta (Kerr 1965) and Alaska (Schoen and Kirschoff 1981), it is recommended that roads and other facilities such as pipelines and powerlines not be constructed in Occupied and Suitable habitat. Recommendations specific to Transitional habitat are provided to reduce the overall effect of roads upon mountain goat habitat on the East Front. Roads should not be constructed within 0.8 km (0.5 mi) of Occupied and Suitable habitat. Existing roads within this 0.8 km buffer zone which approach known kidding-nursery or breeding areas should be obliterated and rerouted. If it is possible to create an effective road closure (strategically located gates), then seasonal restrictions of May 1 to July 15 for kidding-nursery areas and November 1 to December 31 for breeding areas should be enforced. All roads built in Transitional

habitat should be reclaimed after they have served the purpose for which they were built. The Lewis and Clark National Forest Travel Plan should accommodate the needs of mountain goats by incorporating these recommendations when managing roads within mountain goat habitat.

Oil and Gas Exploration

The activity of helicopters and seismic crews are likely more disturbing than seismic blasts, although mountain goats would often startle and run when blasts occurred. Wildlife will panic at the approach of helicopters (McCourt et al. 1974, Miller and Gunn 1979), and mountain goats have been observed falling from cliffs when approached by helicopters (Joslin 1980). Recommendations to confine and reduce the intense level of exploration activity involve:

1) establish helicopter flight paths and enforce strict adherence to a corridor 0.8 km (0.5 mi) in width (corridors should follow water courses in Transitional habitat when possible),
2) require helicopters to maintain heights of 200 m (600 ft) from all ground surfaces,
3) consolidate the number of helicopter trips to complete each line,
4) space concurrently active seismic lines at nine mile intervals to provide an undisturbed corridor into which mountain goats can move when displaced.
5) no human activity should occur within the undisturbed corridor between active lines (including survey crews),
6) the Lewis and Clark National Forest's environmental assessment on oil and gas leasing on nonwilderness lands should be amended to include current information and recommendations concerning mountain goats.

Livestock Grazing

Overlap in range use by mountain goats and cattle occur primarily at mineral licks and can be minimized by implementing guidelines recommended in an earlier section on Mineral Licks. Forage and spatial competition with cattle have not been researched, but other than at lick sites, little direct competition is suspected. However, displacement of other ungulates, particularly bighorn sheep, may result in increased competition between other wildlife and mountain goats. It is recommended that actual and potential competition of various wildlife species and cattle be researched to determine where, when and to what degree forage or spatial requirements overlap. AUMs in current cattle allotments should not be increased, nor should the number of allotments be increased. Domestic sheep are capable of directly competing with mountain goats, therefore, sheep allotments should not be established.

Timber Management

Occupied and Suitable habitats occur on land types having little commercial timber potential. Due to the importance of these areas to goats, no timber harvesting should occur in Occupied and Suitable habitat. No particular restrictions in Transitional habitat are recommended unless access would require crossing Occupied or Suitable habitat, or unless kidding-nursery and breeding areas occur at the edge of Transitional habitat, in which case a 0.8 km (0.5 mi) buffer zone along the boundary must be accommodated.

Fire Control

Heavy equipment should not be used in mountain goat habitat to suppress fires; but if emergency access is built into mountain goat habitat to fight fire, than all roads and trails should be reclaimed immediately after control activities have ceased.

Habitat Manipulation

The generally open nature of mountain goat habitat on the East Front is not conducive to habitat improvement through burning; nor has it been demonstrated that burning can improve mountain goat habitat on or east of the Continental Divide. For the purposes of habitat manipulation, the use of fire should be limited to Transitional habitat, and then only if it is necessary to benefit habitat for other wildlife species.

An important aspect of mountain goat work along the East Front is not only to provide maps of detailed range use by mountain goats and provide recommendations to avoid unnecessary conflict, but also to monitor mountain goats as developments take place to determine whether the recommendations are functioning to avoid or minimize impacts. It may be determined that the recommendations are either inadequate, or overly restrictive and, in either case, they should be modified. Updating and refining the recommendations will ensure that mountain goats are receiving a level of management concern which corresponds to the level of potential human impact and habitat disruption. Monitoring mountain goats leads to a better understanding of their ecology and is a prerequisite to the continued survival of the native mountain goat population along the East Front.

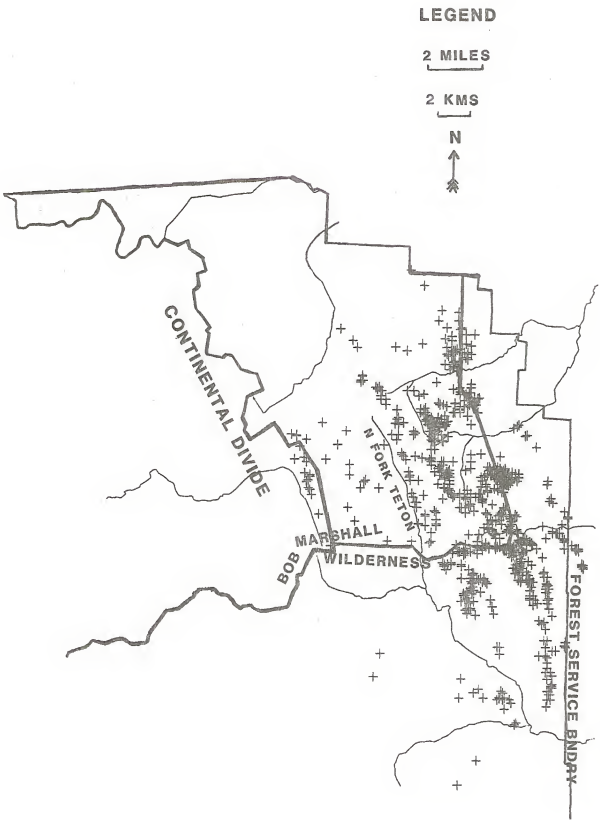

Figure 1. Relocations of 23 radio-marked mountain goats on the East Front, 1979 - 1984.

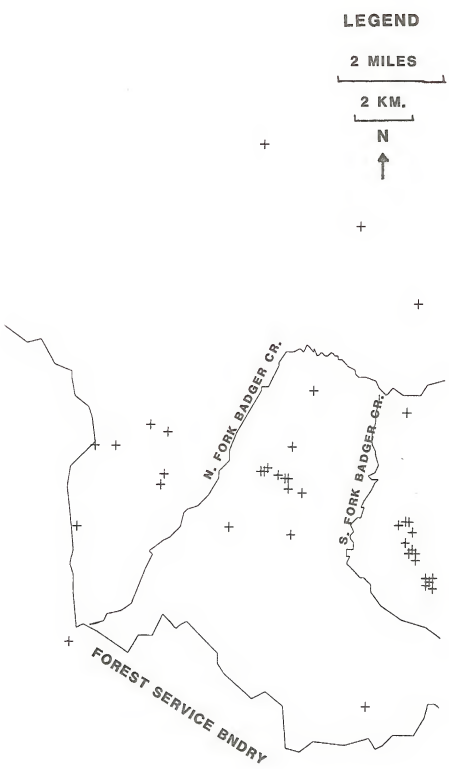

Figure 2. Mountain goat records from the Badger Creek area of the East Front, 1941 - 1984.

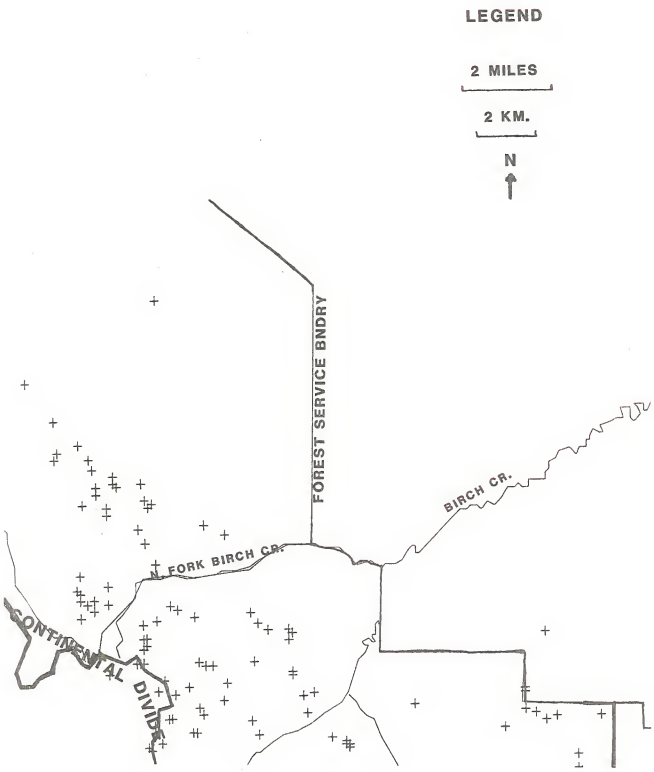

Figure 3. Mountain goat records from the South Badger Creek and North Birch Creek areas of the East Front, 1941 - 1984.

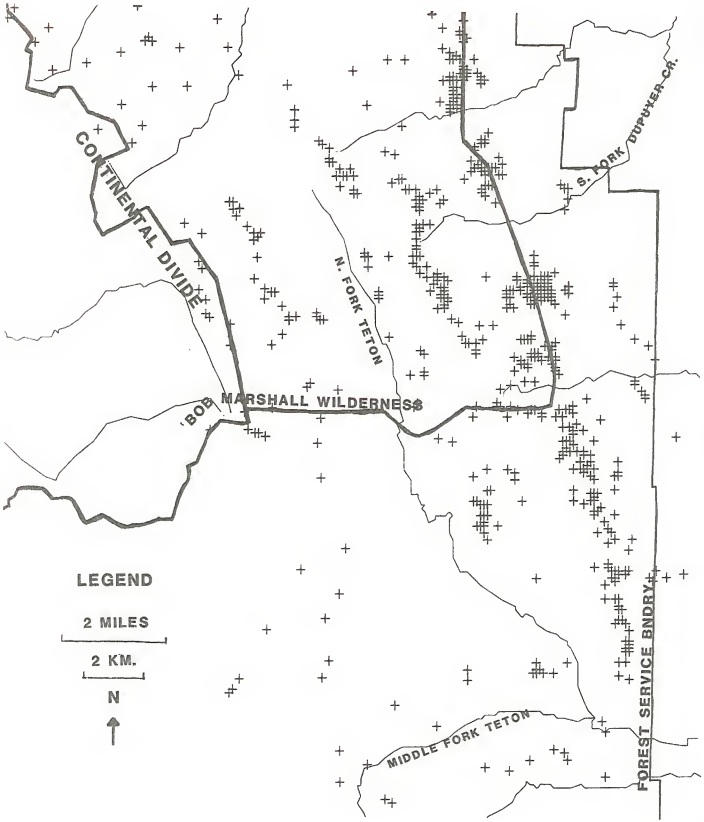

Figure 4. Mountain goat records from the South Birch Creek and Teton River areas of the East Front, 1941 - 1984.

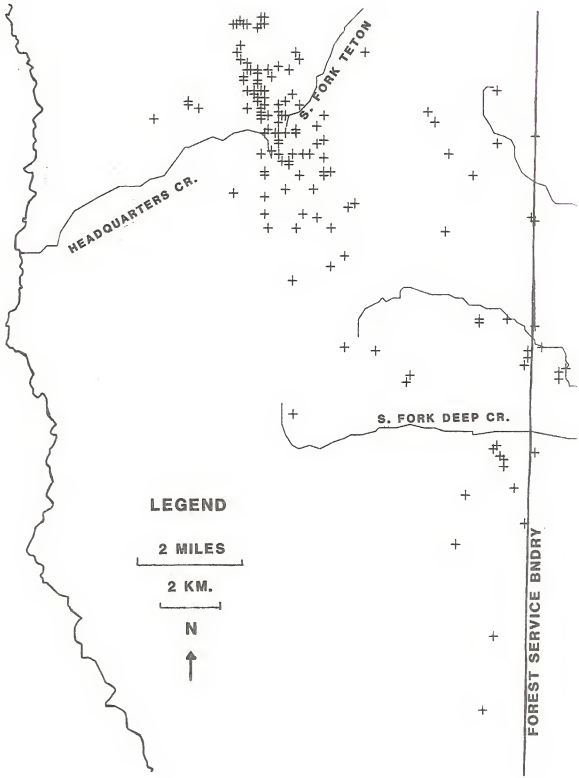

Figure 5. Mountain goat records from the South Teton River and Deep Creek areas of the East Front, 1941 - 1984.

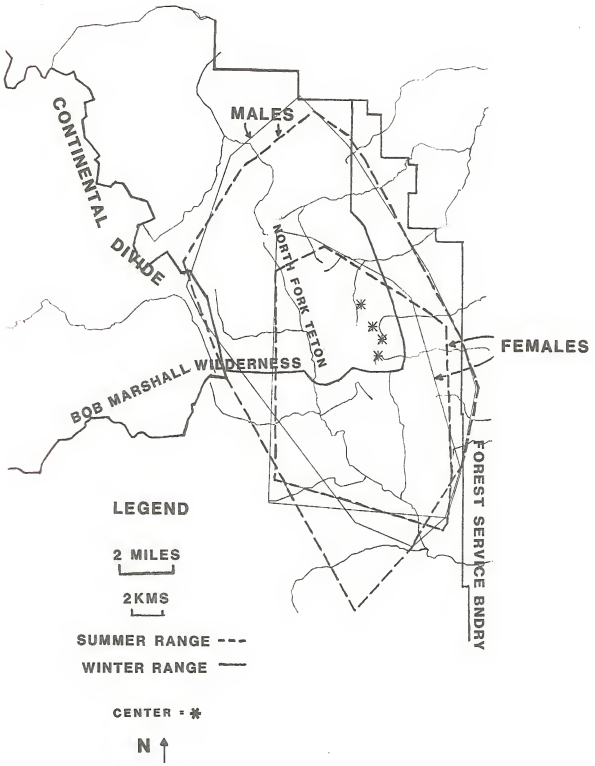

Figure 6. Collective summer and winter home ranges of radio-marked male and female mountain goats on the East Front, 1979 - 1984.

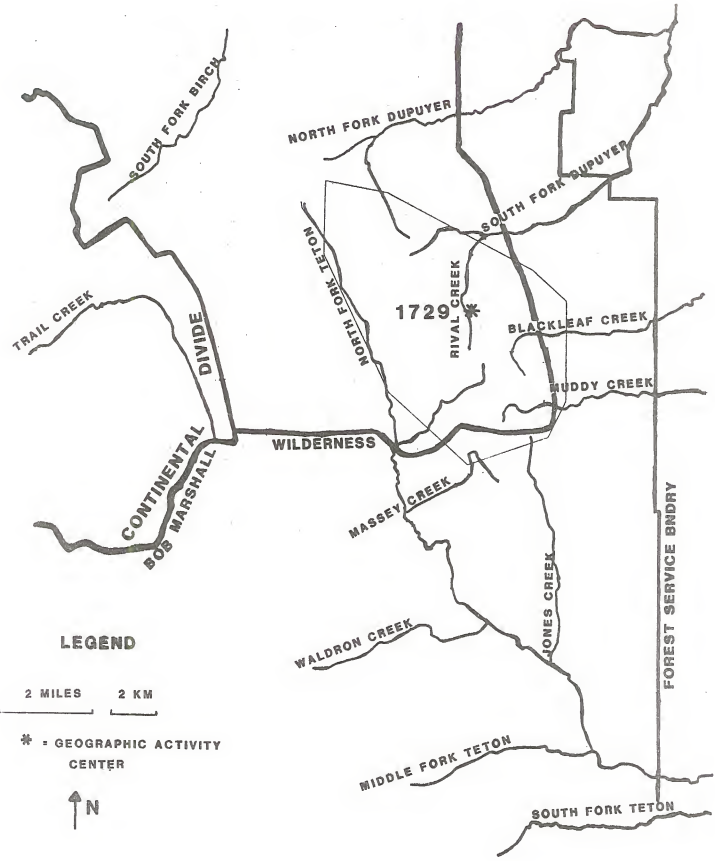

Figure 7. Home Range and Geographic Activity Center of mountain goat 1729.

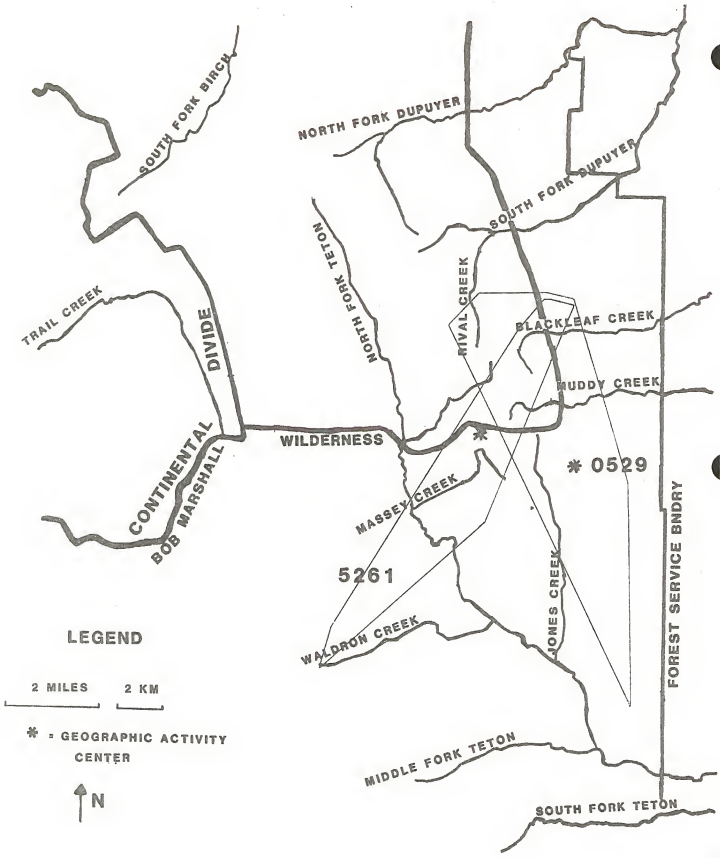

Figure 8. Home Range and Geographic Activity Center of mountain goats 5261 and 0529.

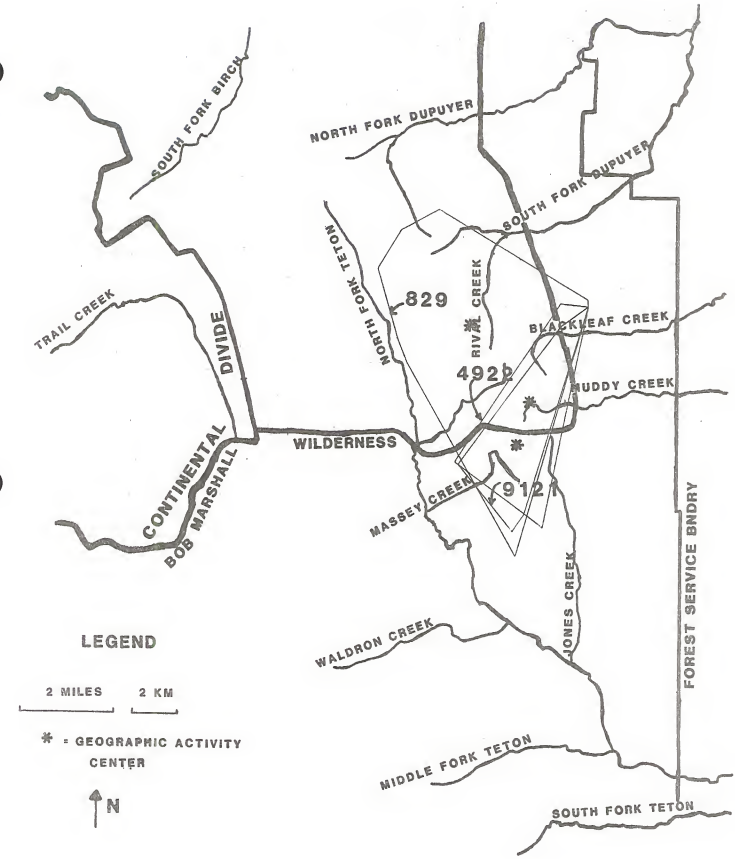

Figure 9. Home Range and Geographic Activity Center of mountain goats 829, 4922, and 9121

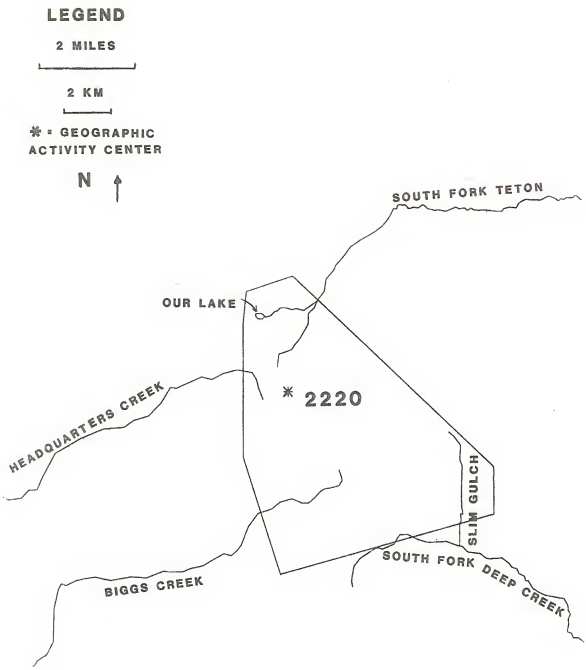

Figure 10. Home Range and Geographic Activity Center of mountain goat 2220.

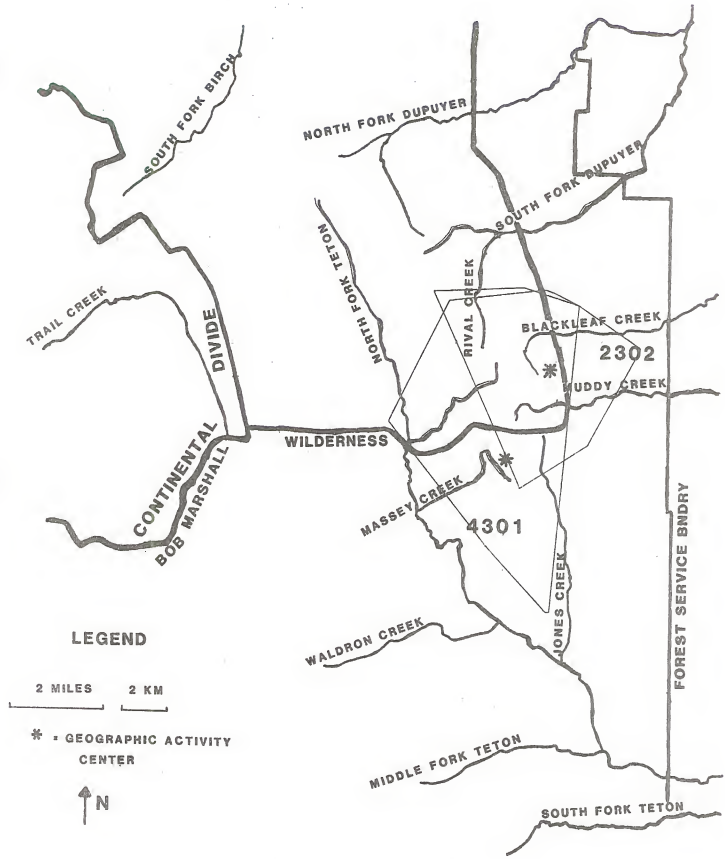

Figure 11. Home Range and Geographic Activity Center of mountain goats 2302 and 4301.

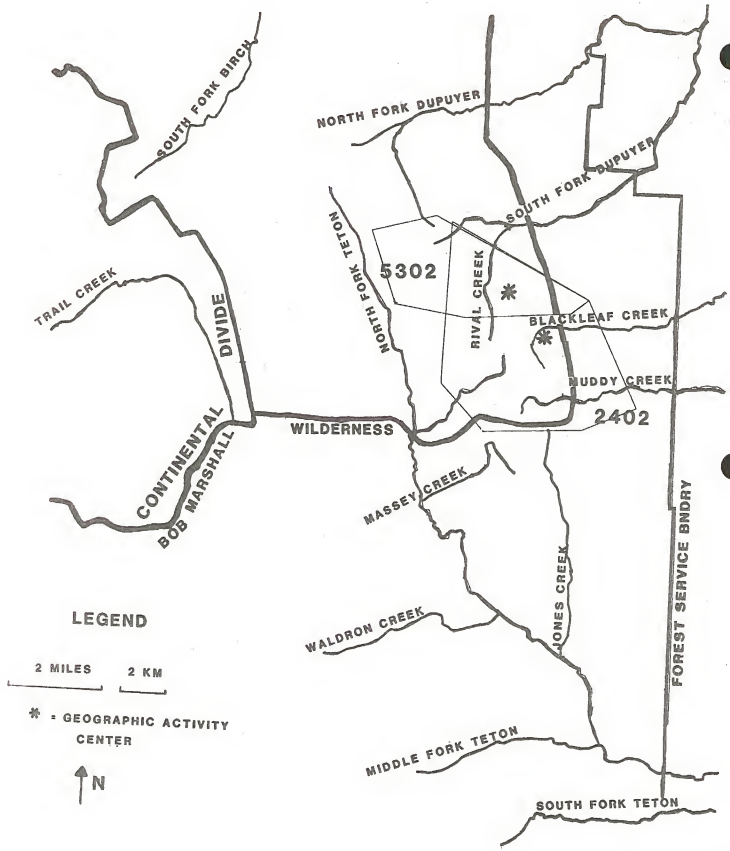

Figure 12. Home Range and Geographic Activity Center of mountain goats 5302 and 2402.

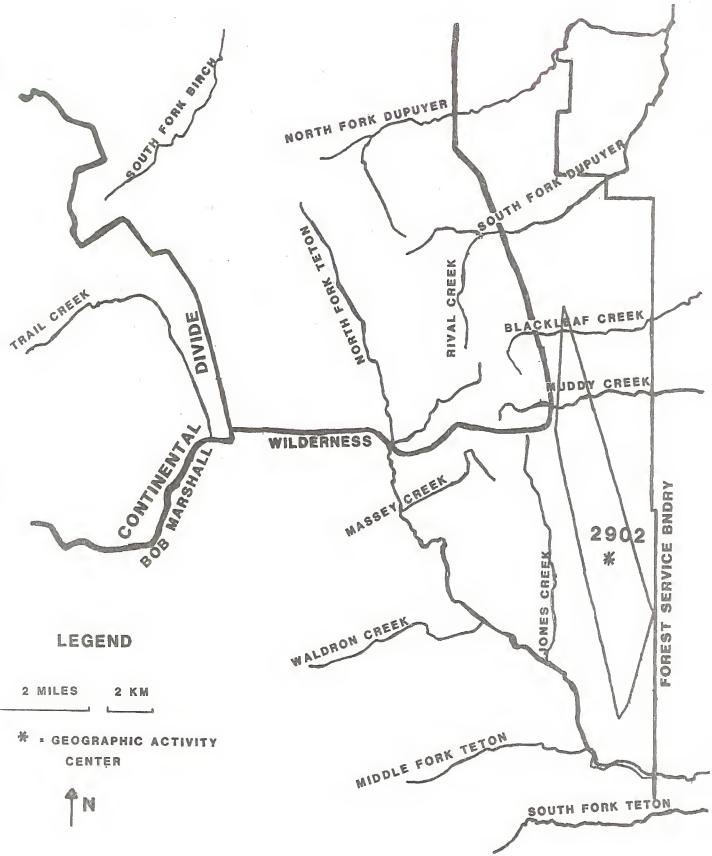

Figure 13. Home Range and Geographic Activity Center of mountain goat 2902.

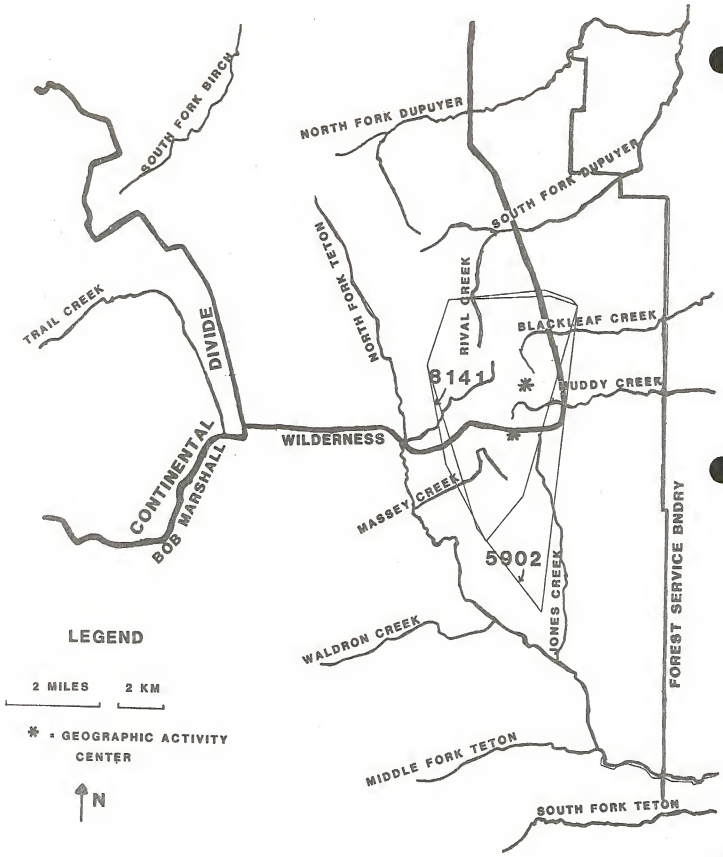

Figure 14 . Home Range and Geographic Activity Center of mountain goats 8141 and 5902.

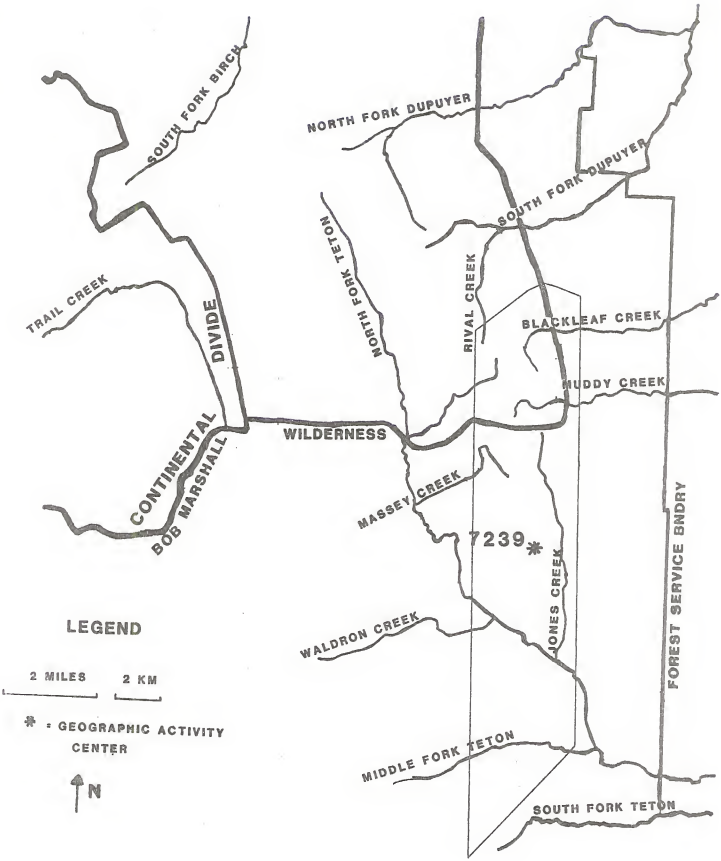

Figure 15. Home Range and Geographic Activity Center of mountain goat 7239.

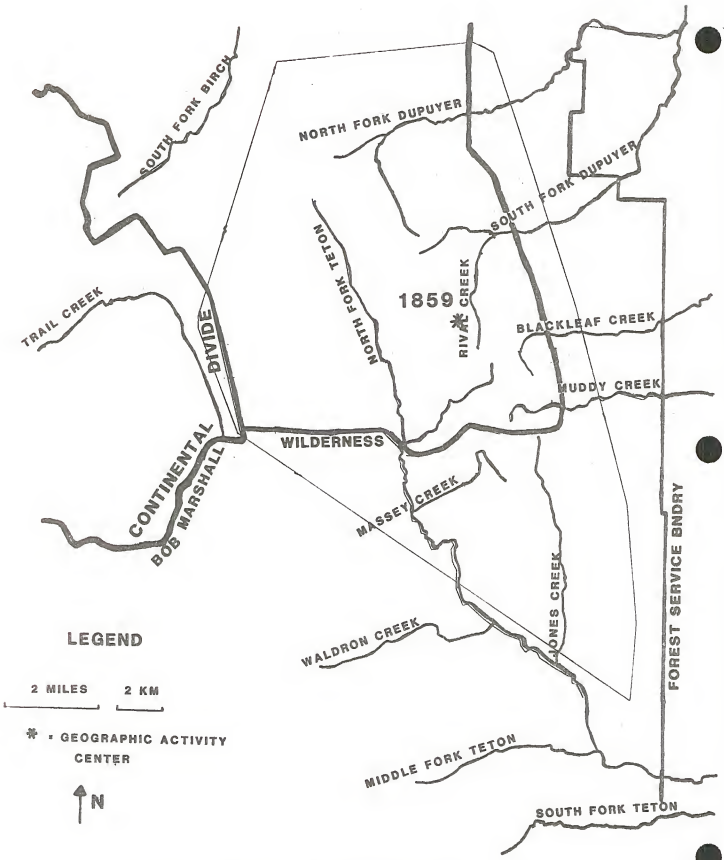

Figure 16. Home Range and Geographic Activity Center of mountain goat 1859.

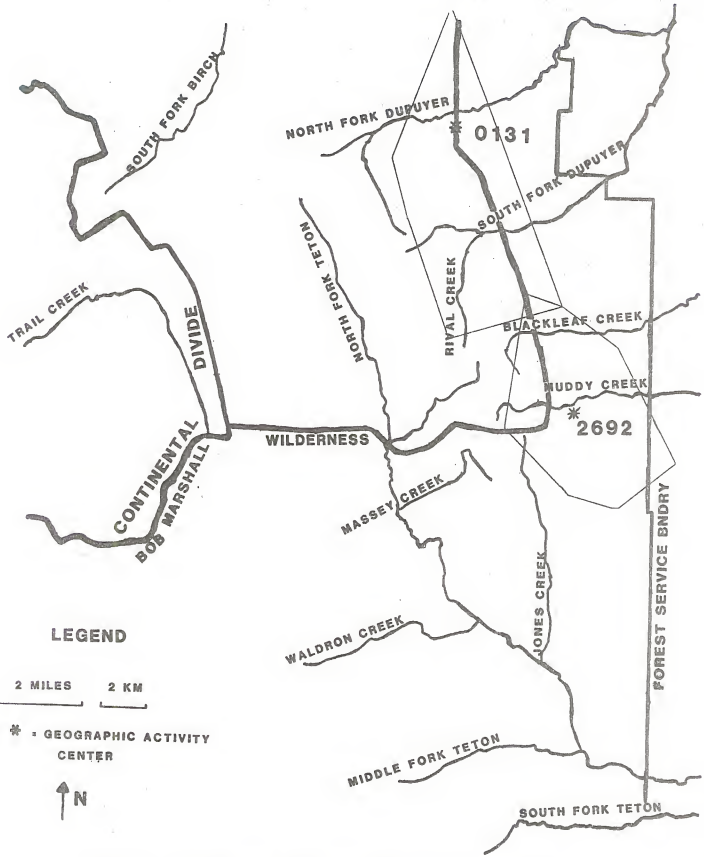

Figure 17. Home Range and Geographic Activity Center of mountain goats 0131 and 2692.

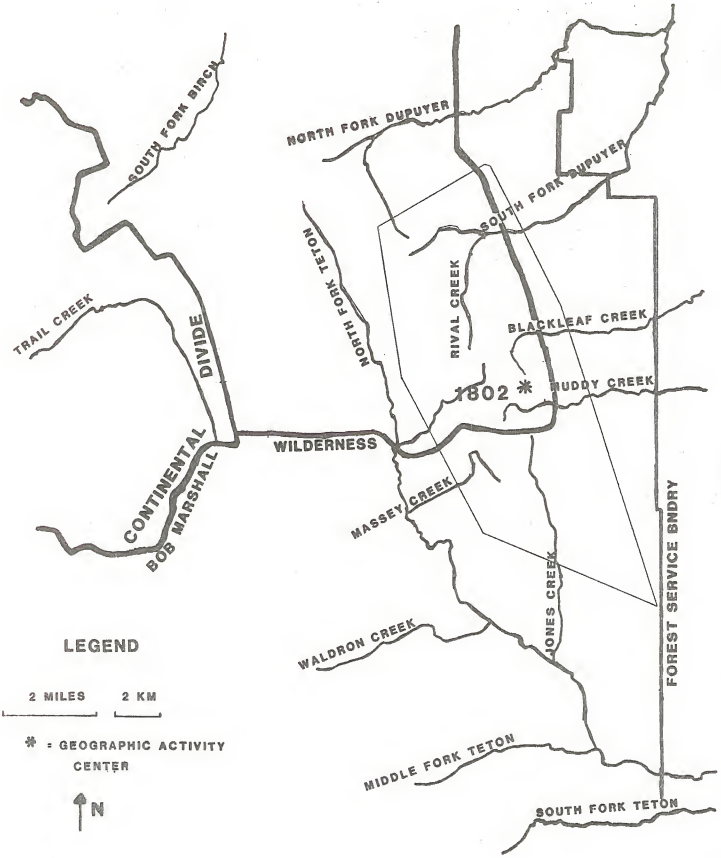

Figure 18. Home Range and Geographic Activity Center of mountain goat 1802.

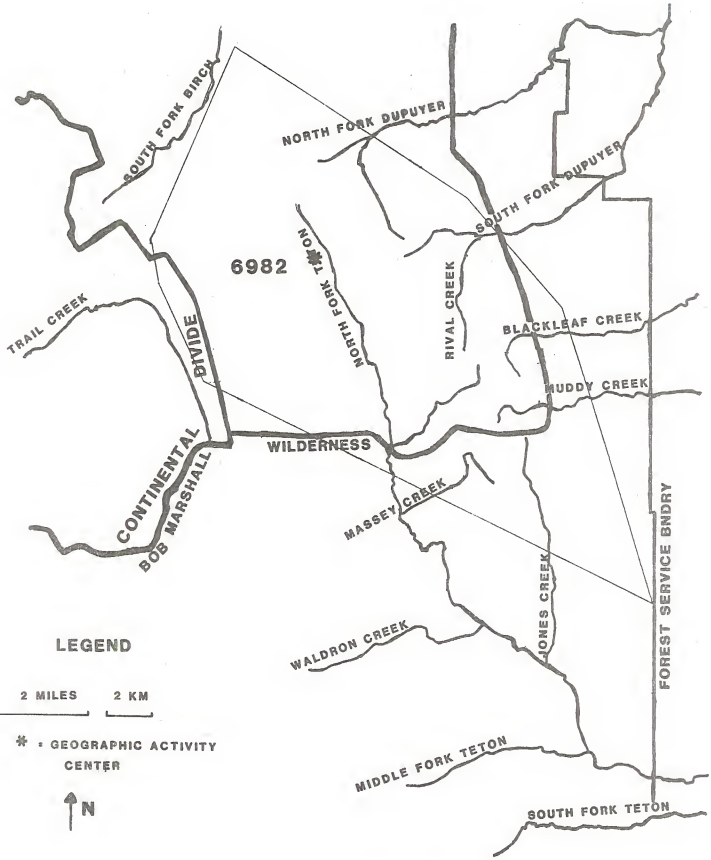

Figure 19. Home Range and Geographic Activity Center of mountain goat 6982.

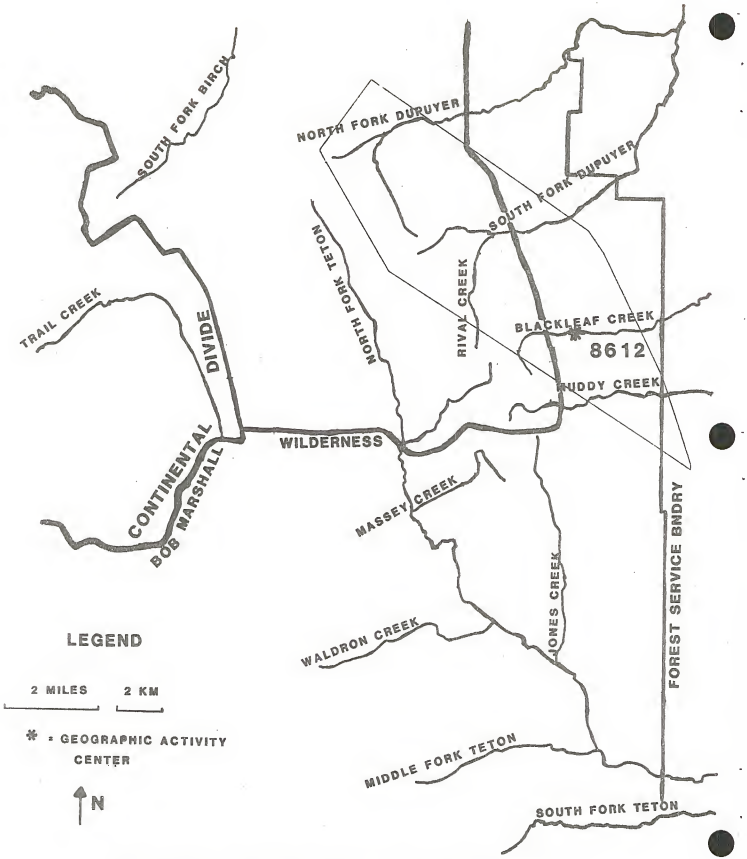

Figure 20. Home Range and Geographic Activity Center of mountain goat 8612.

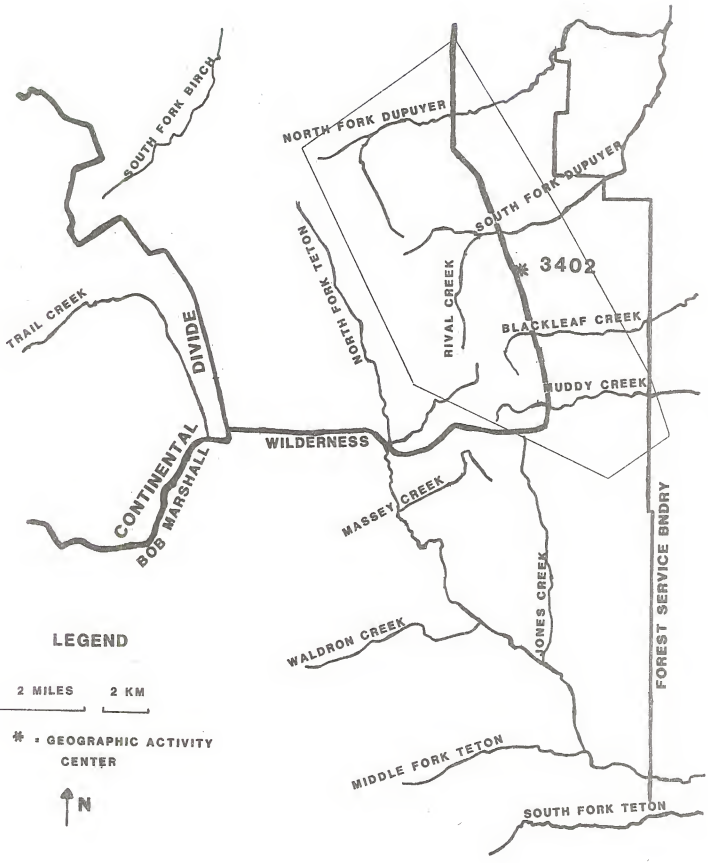

Figure 21. Home Range and Geographic Activity Center of mountain goat 3402.

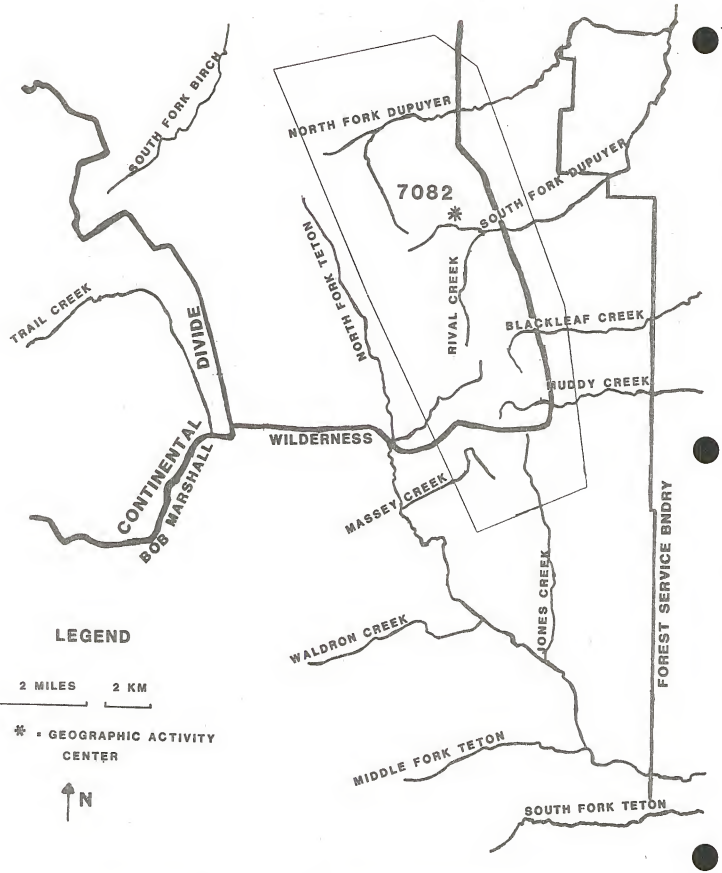

Figure 22. Home Range and Geographic Activity Center of mountain goat 7082.

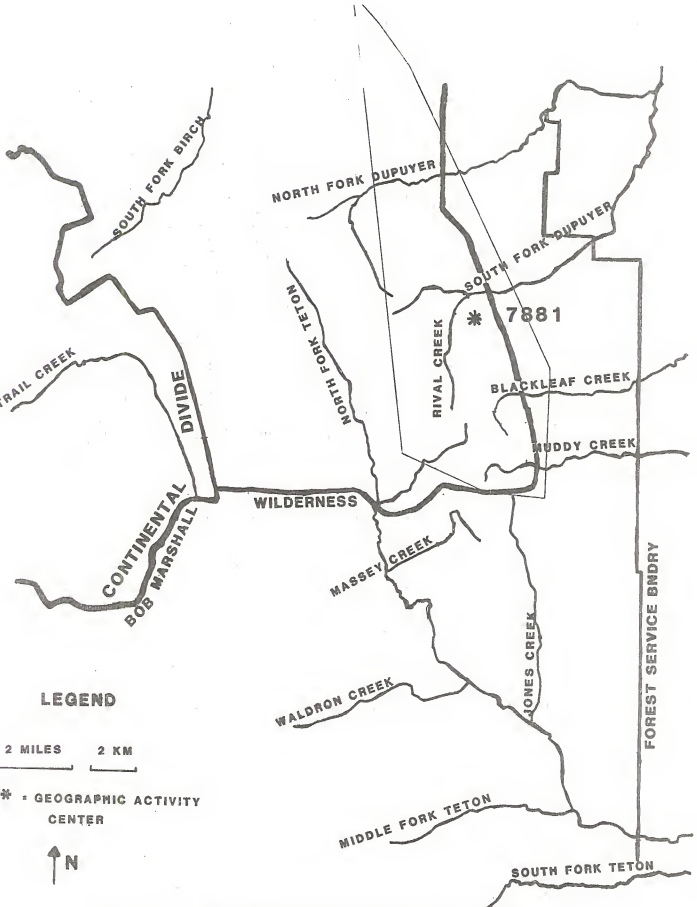

Figure 23. Home Range and Geographic Activity Center of mountain goat 7881.

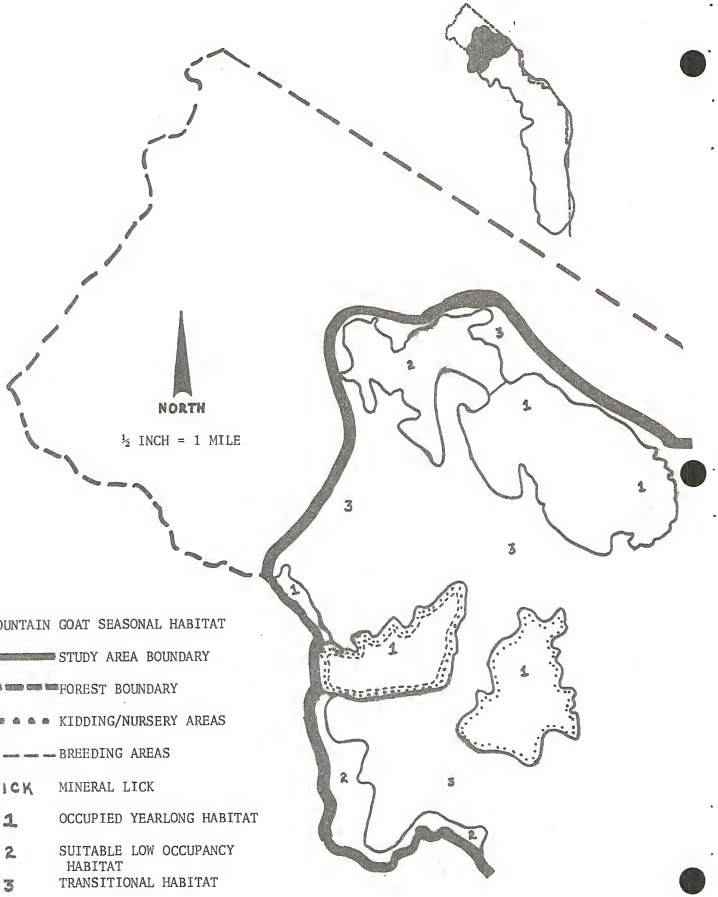

Figure 24. Mountain goat seasonal habitat on the East Front study area.

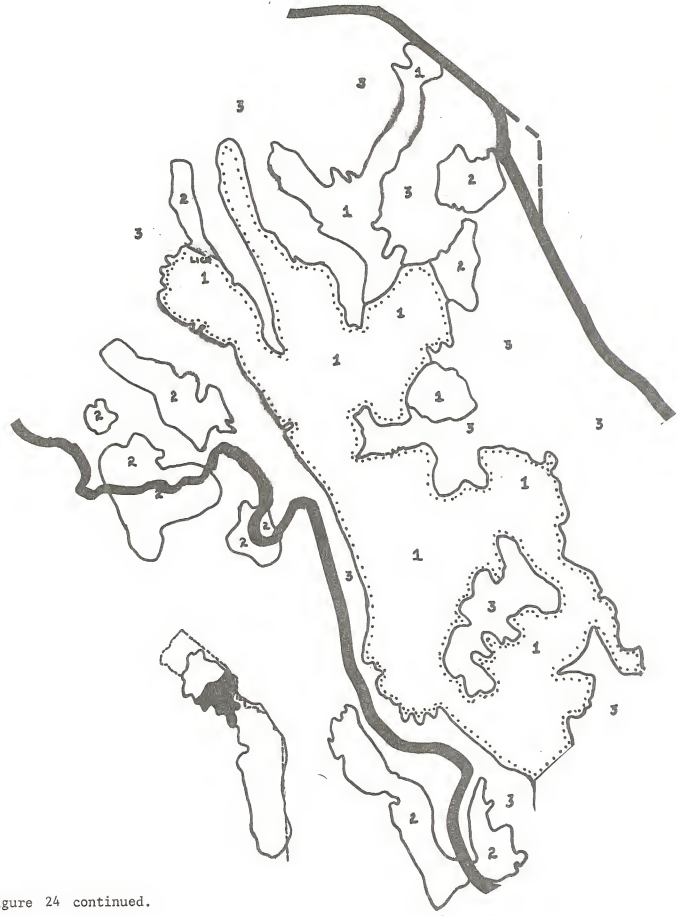

Figure 24 continued.

Figure 24 continued.

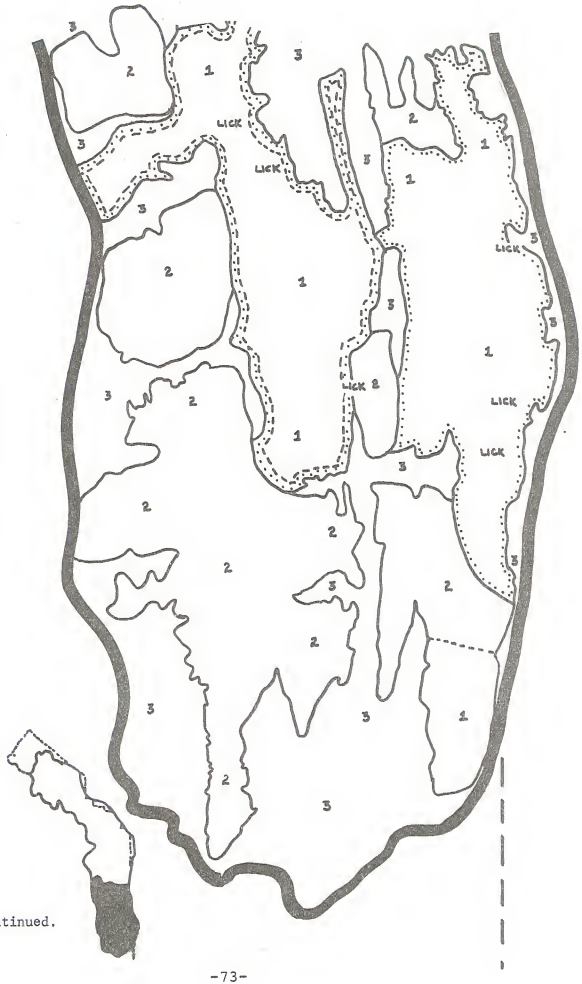

Figure 24 continued.

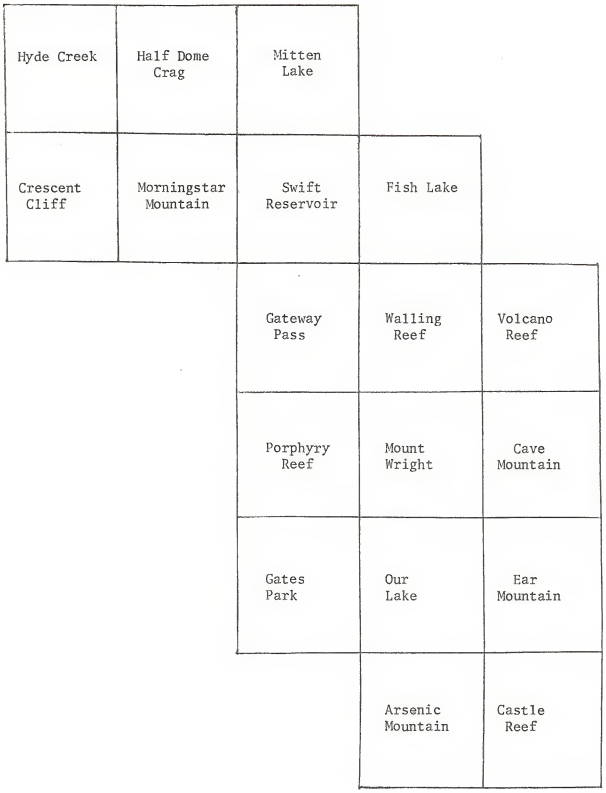

Figure 25. Guide to topographic maps of mountain goat seasonal use areas on the East Front.

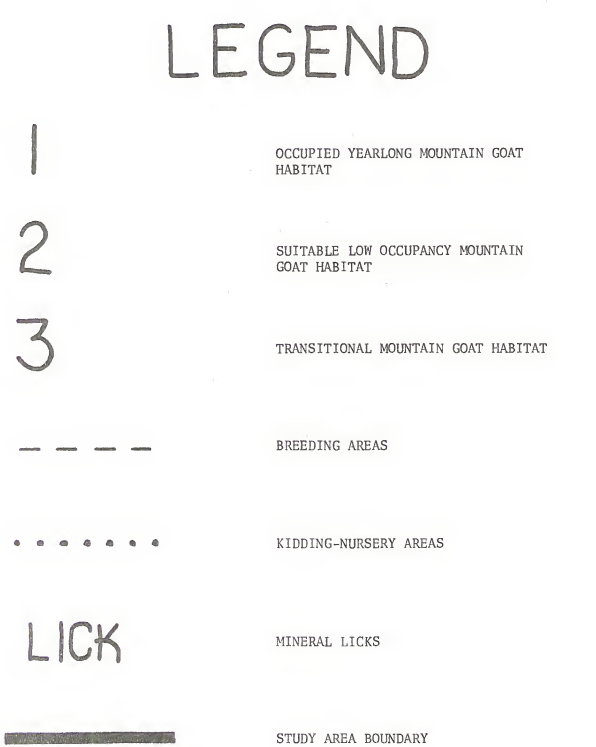

Figure 26. Legend for mountain goat seasonal use maps on the East Front.

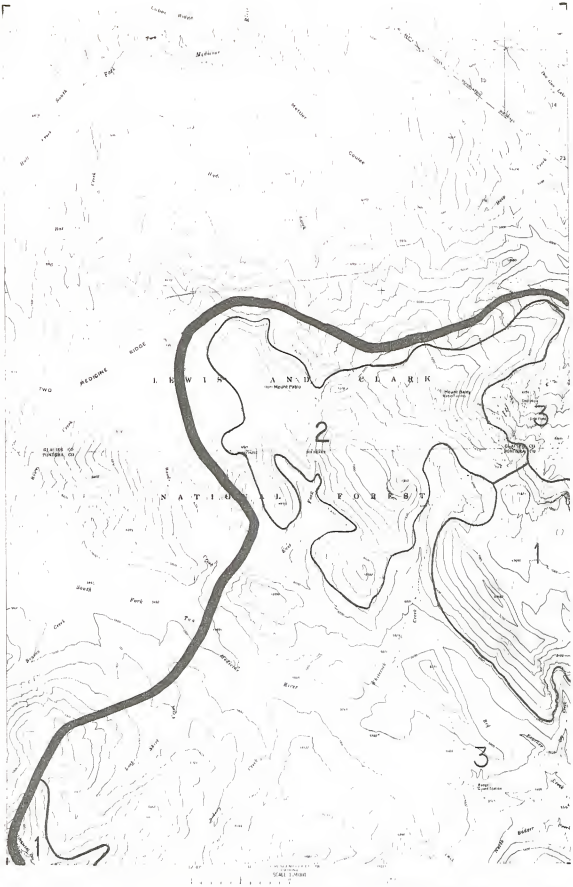

Figure 27. Mountain goat seasonal use areas on the East Front - Hyde Creek.

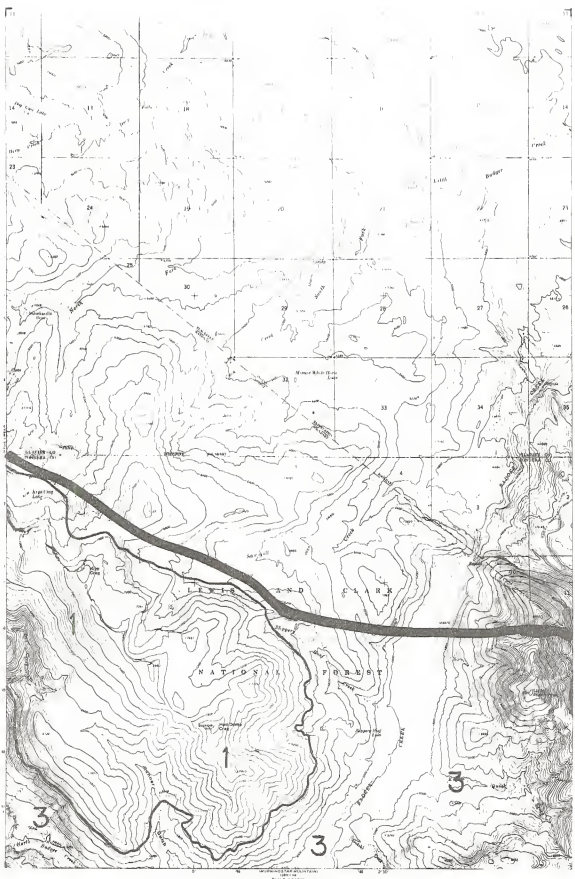

Figure 28. Mountain goat seasonal use areas on the East Front - Half Dome Crag.

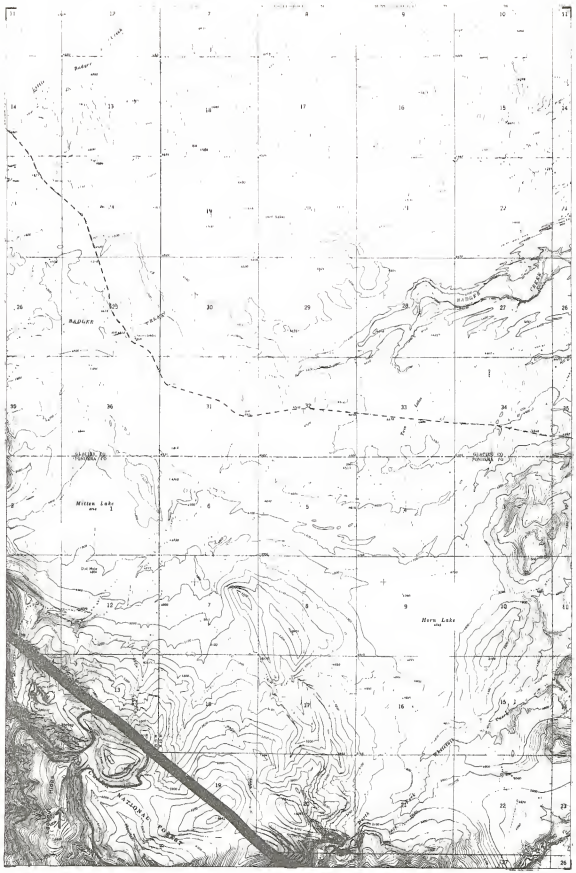

Figure 29. Mountain goat seasonal use areas on the East Front - Mitten Lake.

Figure 30. Mountain goat seasonal use areas on the East Front - Crescent Cliff.

Figure 31. Mountain goat seasonal use areas on the East Front - Morningstar Mountain.

Figure 32. Mountain goat seasonal use areas on the East Front - Swift Reservoir.

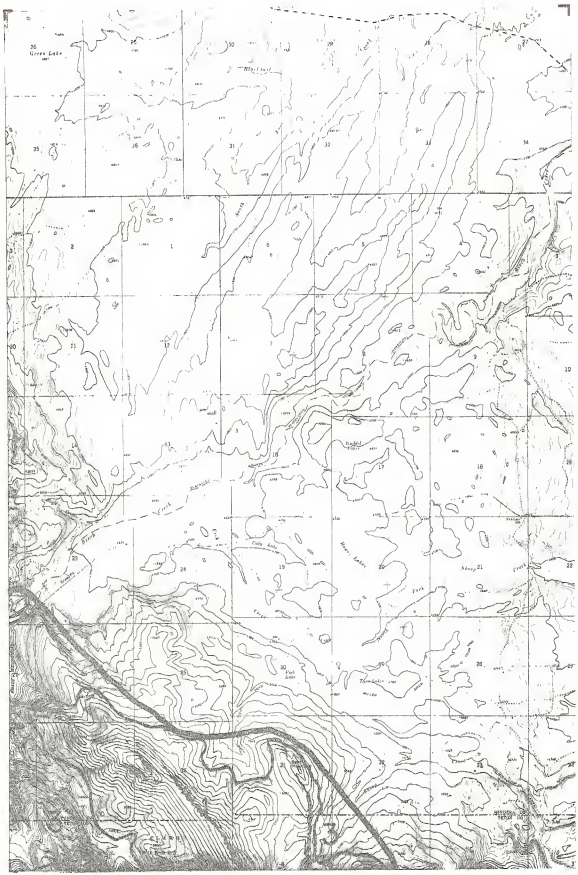

Figure 33. Mountain goat seasonal use areas on the East Front - Fish Lake.

Figure 34. Mountain goat seasonal use areas on the East Front - Gateway Pass.

Figure 35. Mountain goat seasonal use areas on the East Front - Walling Reef.

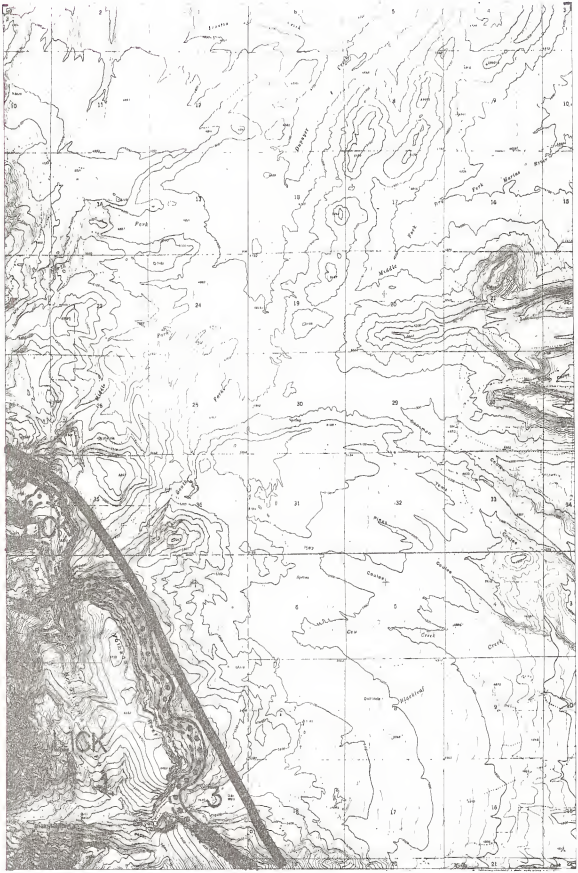

Figure 36. Mountain goat seasonal use areas on the East Front - Volcano Reef.

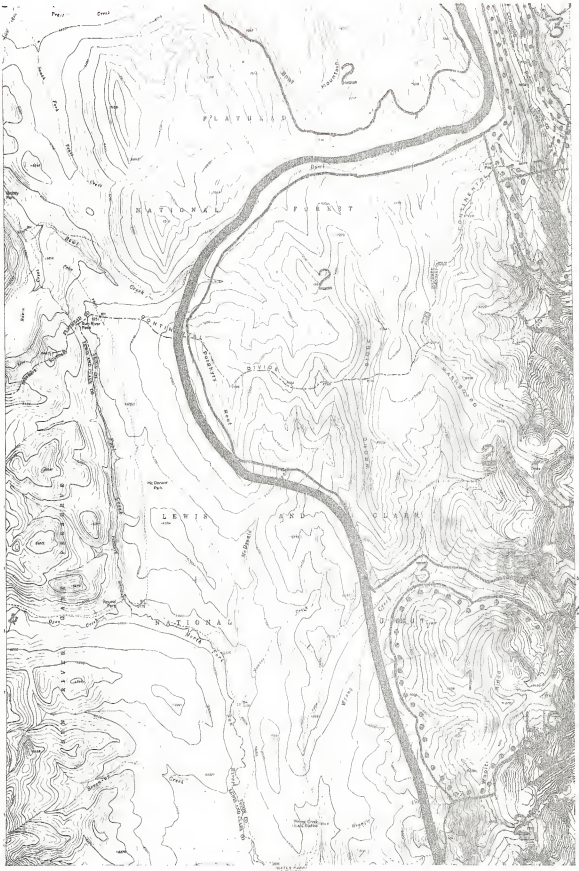

Figure 37. Mountain goat seasonal use areas on the East Front - Porphyry Reef.

Figure 38. Mountain goat seasonal use areas on the East Front Mount Wright.

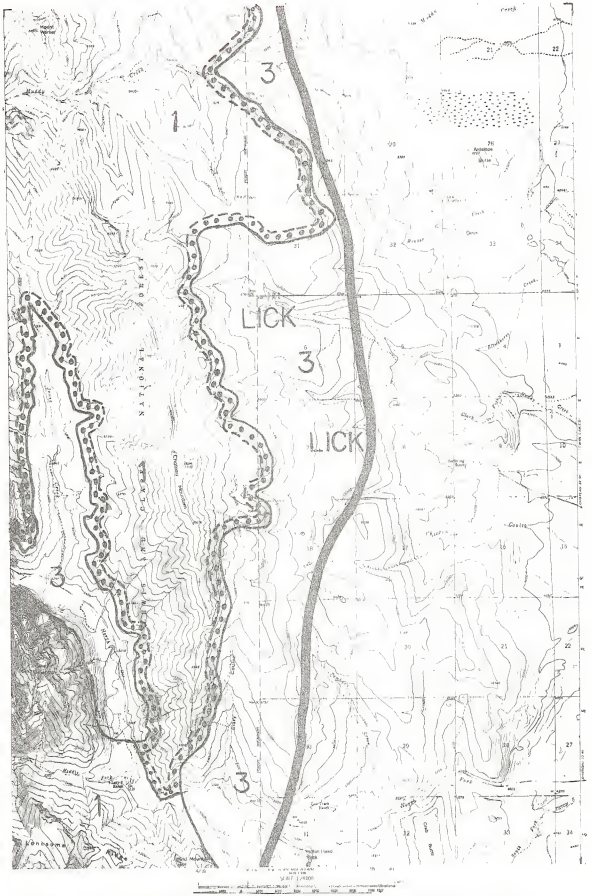

Figure 39. Mountain goat seasonal use areas on the East Front - Cave Mountain.

Figure 40. Mountain goat seasonal use areas on the East Front - Gates Park.

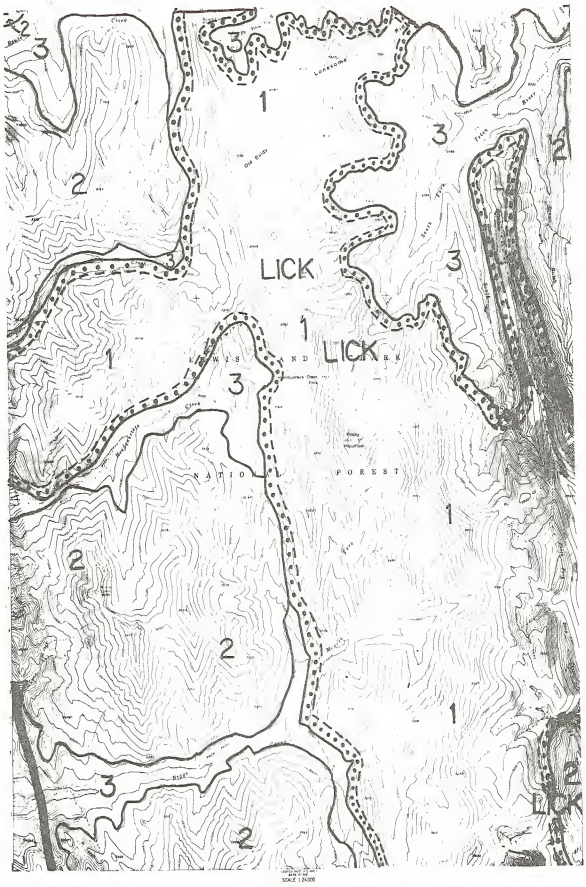

Figure 41. Mountain goat seasonal use areas on the East Front - Our Lake.

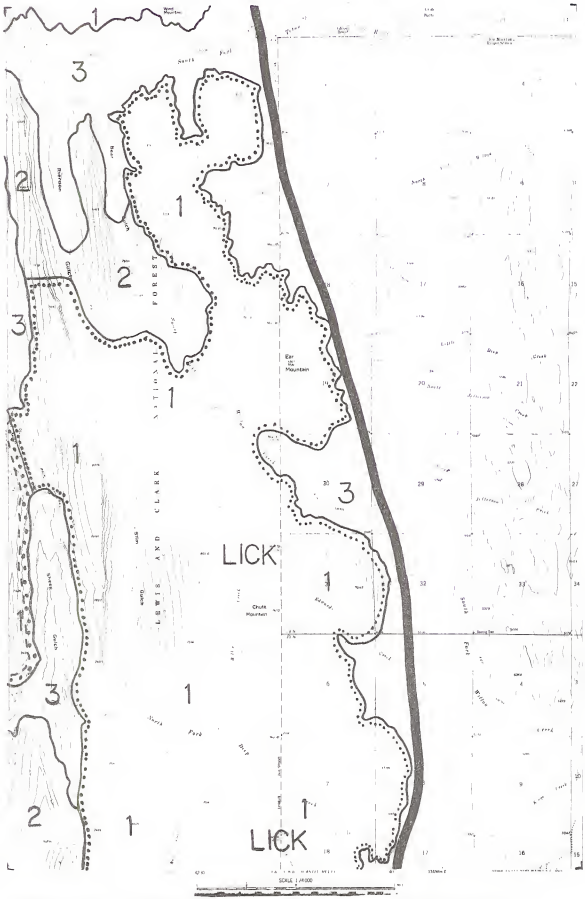

Figure 42. Mountain goat seasonal use areas on the East Front - Ear Mountain.

Figure 43. Mountain goat seasonal use areas on the East Front - Arsenic Mountain.

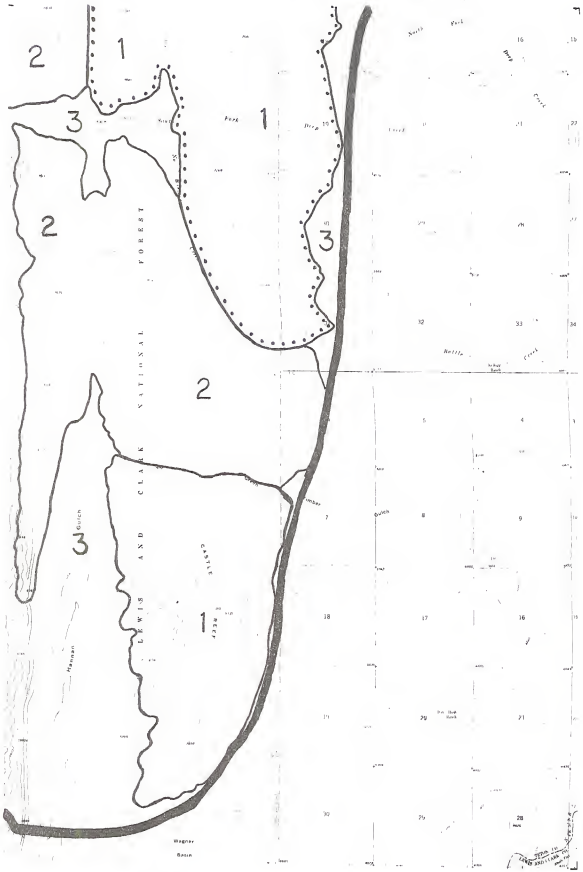

Figure 44. Mountain goat seasonal use areas on the East Front - Castle Reef.

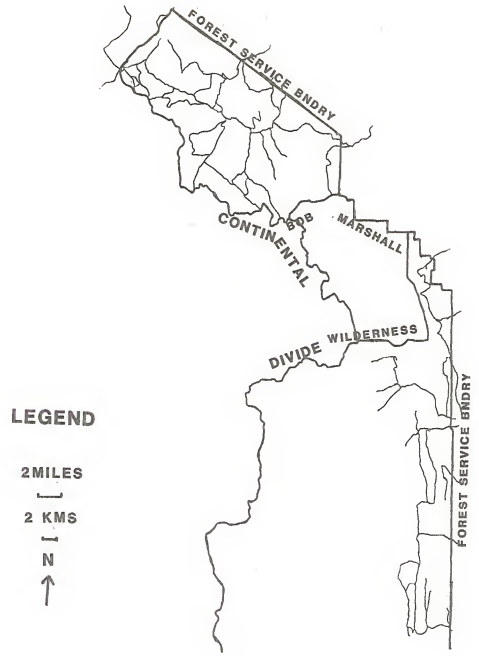

Figure 45. Roads and Trails on the East Front receiving some type of motorized use.

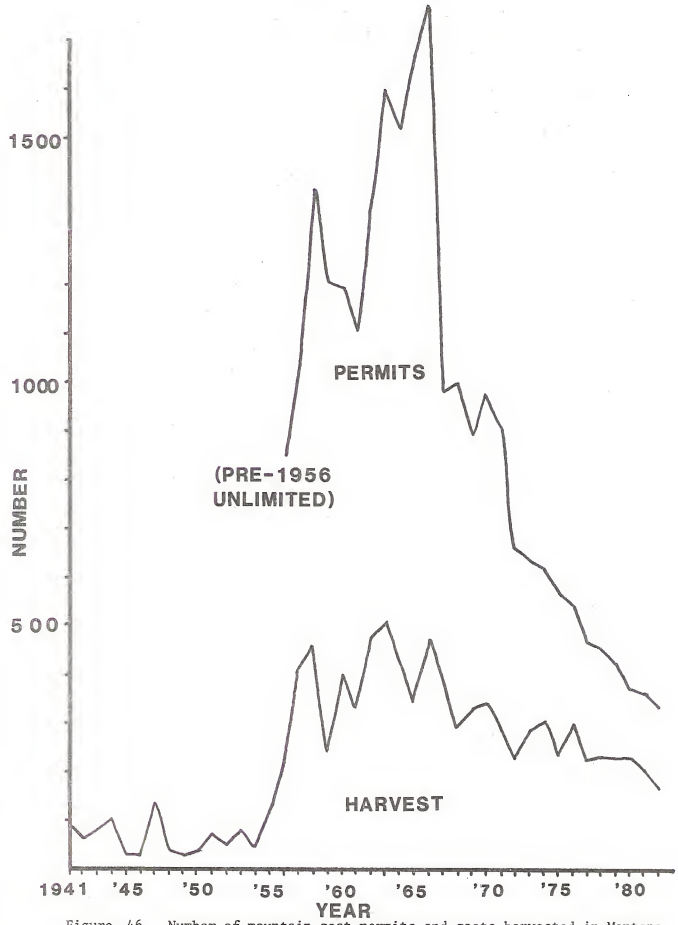

Figure 46. Number of mountain goat permits and goats harvested in Montana, 1941 - 1982.

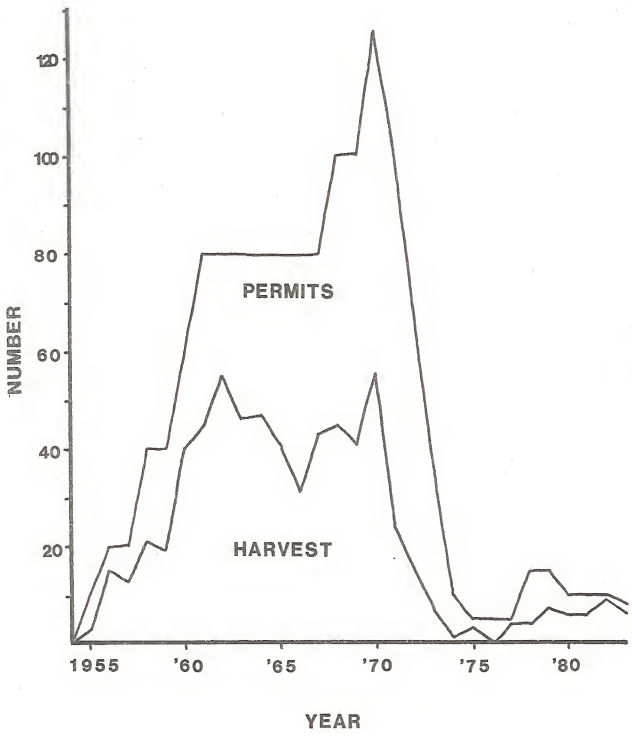

Figure 47. Number of mountain goat permits and goats harvested on the East Front, 1955 - 1983.

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APPENDIX

Appendix 1. Monthly climatological data from three stations on the East Front (Blackleaf, East Glacier, Gibson Dam).

m = Insuffient or partial data
t = Trace

Month 1983	Ave. Max. °F	Ave. Min. °F	Ave.	Ppt. Total	Snow Total	Max. Depth on Ground
Dec						
	44.8	22.8	33.8	.53	8.0m	0
Nov	39.4	23.8	31.6	2.11	15.0m	7
	m	m	m	-	m	m
	61.8	29.4	45.6	.02	.0	.0
Oct	53.8	32.7	43.3	.39	.0	.0
	58.5	35.3	46.9	.07	.0	.0
	66.9	36.8	51.9	1.41	m	m
Sept	59.1m	35.3	47.2m	2.28	9.0m	5
	63.6	38.2	50.9	1.17	6.0	4
	86.0	53.1	69.6	.35	0	0
Aug	78.6	46.8	62.7	.44	0	0
	81.9	49.5	65.7	1.66	0	0
	m	m	m	-	m	m
July	69.5	44.7	57.1	2.32	0	0
	74.8	46.9	60.9	1.87	0	0
		42.3	56.0	1.63	0	0
	69.6	40.9	52.8	2.57	0	0
June	64.7	43.3	56.0	3.76	0	0
	68.6	m	m	-	m	m
	m	33.8	45.9	.86	2.0	2
May	57.9	34.0	47.5	1.96	10.0	10
	60.9	24.8	38.6	.19	m	0
	52.4	25.7	38.3m	.38	m	21
Apr	50.9	26.6	38.4	.61	3.0	3
	50.2	22.5	33.5		m	m
	44.5	20.6	31.1	.98	17.0	25
	41.5	23.8	33.9	2.29	21.5	19
March	43.9			2.03		
	46.8	21.8	34.3	.18	1.0m	m
Feb	39.9	23.4	31.7	1.07	3.0m	20
	44.5	25.2	34.9	.09	.5	1
	m	m	m	-	m	m
Jan	37.2	18.1	27.7	3.32	25.2	26
	42.4	23.5	33.0	.49	.2	t

Appendix 1 continued.

Month 1982	Ave. Max. °F	Ave. Min. °F	Ave.	Ppt Total	Snow Total	Max. Depth on Ground
Dec	36.4	13.9	25.2	.26	4.0	
	31.2	15.6	23.4	2.89	28.0	20
	35.6	19.9	27.8	.55	8.0	3
Nov	39.2	12.9	26.1	.37	4.0	
	33.3	14.8	24.1	2.40	29.0	18
	39.4	19.6	29.5	.55	11.0	6
Oct	60.1	29.1	44.6			
	50.2	29.5	39.9	0.49	2.0	2
	56.2	33.2	44.7	0.21	0.5	0
Sept	68.6	36.9	52.8	1.84	2.0	0
	60.9	37.7	49.3	1.79	6.0	4
	65.1	39.1	52.1	2.63	m	m
Aug	81.8	46.7	64.3	.89	0	0
	72.6	43.1	57.9	0.94	0	0
	77.7	47.0	62.4	0.86	0	0
Jul	77.2	48.5	62.9	0.69	0	0
	71.7	44.3	58.0	0.57	0	0
	75.2	47.3	61.3	0.86	0	0
Jun	70.2	44.6	57.4	3.51	0	0
	68.6	38.8	53.7	1.88	t	t
	68.9	42.8	55.9	2.33	0	0
May	61.8	31.1	46.5	3.19	8.0	t
	55.1	30.1	42.6	2.81	12.0	29
	59.4	32.8	46.1	1.45	3.0	3
Apr	49.9	23.1	36.5	0.35	4.5	t
	42.8	19.9	31.4	1.61	30.0	47
	46.9	24.4	35.7	0.92	11.0	12
Mar	38.0	15.4	26.7	0.92	18.0	
	39.3	12.3	25.8	3.14	37.0	45
	40.0	20.4	30.2	1.61	23.5	18
Feb	35.0	6.9	21.0	0.65	4.5	
	29.5	8.7	19.1	3.87	18.0	33
	33.9	12.1	23.0	1.91	13.5	10
Jan	16.2	-6.4	4.9	1.0	17.0	
	19.9	-4.4	7.8	4.57	63.0	33
	28.2	4.4	16.3	1.39	22.8	11

Appendix 1 continued.

Month 1981	Ave. Max. °F	Ave. Min. °F	Ave.	Ppt Total	Snow Total	Max. Depth on Ground
Dec	33.5	11.6m[1/]	22.6m	0.28	-	-
	31.2m	13.3m	22.3m	2.97	18.0	12
	33.3	16.8	25.1	0.94	7.5	5
Nov	m	m	m	0.10	1.0	-
	44.3m	26.6m	35.5m	1.72	13.0	9
	48.3	27.8	38.1	0.20	1.0	1
Oct	56.2	32.8	44.5	1.12	7.0	-
	49.6	27.4	38.5	0.96	8.0	-
	53.5	31.6	42.6	1.12	0	-
Sept	72.3	39.2	55.8	.20	0	0
	65.3	35.2	50.3	.36	0	0
	70.7	39.3	55.0	.49	0	0
Aug	83.5	48.4	66.0	2.21	0	0
	78.2	41.7	60.0	.74	0	0
	80.7	46.0	63.4	1.59	0	0
Jul	79.4	47.1	63.3	1.21	0	0
	72.3	43.5	57.9	1.50	0	0
	77.3	46.4	61.9	1.88	0	0
Jun	-	-	-	-	-	-
	62.4	38.9	50.7	2.21	0	0
	64.8	41.3	53.1	1.62	0	0
May	-	-	-	-	-	-
	-	-	-	-	-	-
	58.7	38.8	48.8	6.97	0	0
April	57.6	28.5	43.1	t	t	0
	-	-	-	-	-	-
	53.3	32.1	42.7	.26	0	0
Mar	50.8	21.2	36.0	2.29	-	-
	-	-	-	-	-	-
	48.6	24.2	36.4	.83	-	1
Feb	-	-	-	-	-	-
	-	-	-	-	-	-
	39.8	20.2	30.0	.68	11.0	7
Jan	45.2	18.9	32.1	.33	-	-
	-	-	-	-	-	-
	42.3	21.8	32.1	.16	3.7	3

Appendix 1 continued.

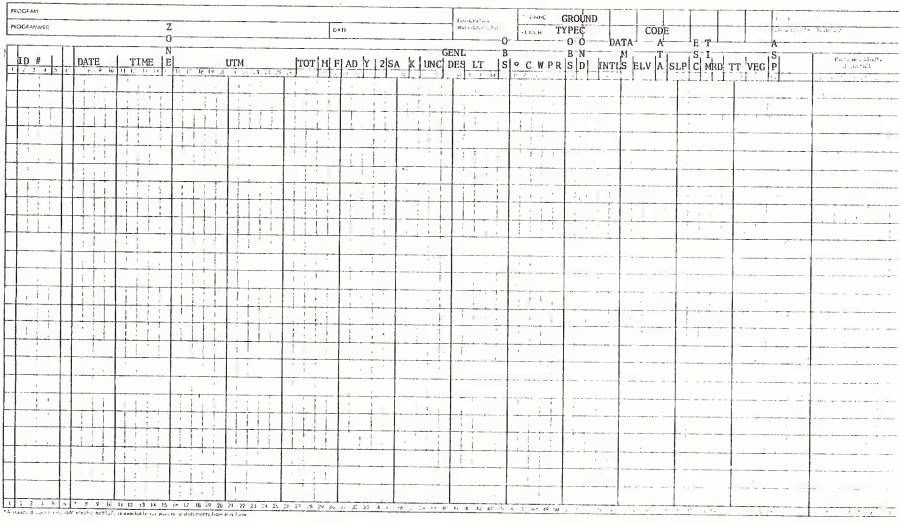
Month 1980	Ave. Max. °F	Ave. Min. °F	Ave.	Ppt Total	Snow Total	Max. Depth on Ground
Dec	33.2	4.7	19.0	.62	11.0	-
	-	-	-	-	-	-
	36.8	16.4	26.6	1.12	9.5	7
Nov	-	-	-	-	-	-
	-	-	-	-	-	-
	46.5	26.8	36.7	.46	4.5	3
Oct	61.6	31.5	46.6	1.37	3.0	-
	-	-	-	-	-	-
	59.6	33.9	46.8	1.30	-	2
Sept	67.0	39.2	53.1	1.12	1.0	0
	-	-	-	-	-	-
	66.9	42.3	54.6	1.37	0	0
Aug	71.4	42.8	57.1	1.41	0	0
	-	-	-	-	-	-
	70.8	43.2	57.0	1.03	0	0
Jul	80.3	49.3	64.8	.24	0	0
	-	-	-	-	-	-
	77.7	46.8	62.3	.67	0	0
Jun	-	-	-	-	-	-
	-	-	-	-	-	-
	67.0	41.9	54.5	5.17	0	0
May	65.4	39.1	52.3	4.04	t	0
	-	-	-	-	-	-
	64.1	38.1	51.1	6.09	0	0
April	58.8	31.2	45.0	2.10	25	0
	-	-	-	-	-	-
	60.1	30.8	45.5	2.30	14.0	14
March	37.9	17.1	27.5	.87	-	-
	-	-	-	-	-	-
	39.1	20.9	30.0	.46	5.2	4
Feb	37.5	15.8	26.7	.82	-	-
	40.1	18.2	29.2	.82	18.0	11
Jan	24.7	1.0	12.9	.97	12.5	-
	-	-	-	-	-	-
	28.5	3.1	15.8	1.27	16.8	13

1/ Incomplete data for month.

Appendix 2. °F Annual climatological data from three stations on the East Front (Blackleaf, East Glacier, Gibson Dam).

Year	°F Max	°F Min	Ave.	Ppt
1982	90	-30	39.1	-
	85	-33	36.1	26.96
	86	-28	40.4	15.27
1981	96	-35	32.1	13.76
	89	-	-	20.41
	94	-29	32.1	16.74
1980	91	-28	-	18.16
	-	-	-	32.74
	92	-29	42.5	22.06
1979	92	-34	41.6	7.89
	-	-	-	-
	92	-20	41.9	10.68
1978	91	-28	40.9	18.40
	-	-	-	29.87
	89	-34	40.5	17.59
1977	90	-31	41.8	13.44
	-	-	-	27.22
	88	-26	42.1	16.18
1976	92	-24	44.1	15.46
	-	-	-	-
	91	-26	43.6	13.26
1975	93	-25	39.1	25.35
	-	-	-	43.72
	92	-22	39.8	27.36
1974	94	-29	42.8	11.0
	-	-	-	15.31
	89	-24	43.6	24.44
1973	99	-20	42.5	5.27
	-	-	-	17.21
	96	-22	42.6	8.11
1972	89	-42	38.9	16.42
	-	-	-	42.03
	89	-34	40.4	17.70
1971	93	-40	-	11.68
	-	-	-	35.94
	91	-25	41.2	20.03
1970	-	-25	41.0	16.47
	-	-	-	34.66
	91	-35	-	18.84

Appendix 3. Mountain goat observation form.

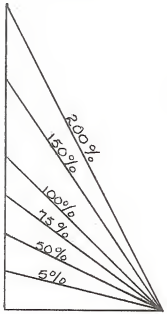


Appendix 4. Codes for mountain goat observation form.

Column		Column	
1-4	Goat ID No.	47	Clouds 1 = clear 2 = ptly cloudy 3 = mostly cloudy 4 = overcast
5-10	Day, month, year	48	Wind - Beaufort numbers code MPH indicators
11-14	Military time		0 = 1 smoke rises vertically
15	Zone 2		1 = 1-3 smoke drifts 2 = 4-7 leaves rustle
16-26	UTM - universal transverse mercator		3 = 8-12 leaves/twigs in constant motion 4 = 13-18 raises dust & loose paper
27-28	Total no. goats observed		5 = 19-24 small trees in leaf, sway 6 = 25-31 large branches in motion
29	Adult males		7 = 32-38 whole trees in motion 8 = 39-46 breaks twigs off trees
30	Adult females	49	9 = over 47 structural damage Precipitation type 0 = none 1 = rain 2 - hail or sleet 3 = snow
31-32	Unclassified adults (sex)	50	Precipitation rate 0 = none 1 = light 2 = moderate 3 = heavy
33	Yearlings	51	Type observation 1 = air 2 = ground
34	Two-year-olds	52	Ground condition 1 = dry 2 = damp 3 = wet, muddy
35-36	Unclassified subadults (age)		4 - scattered snow 5 = snow 6"
37	Kids		6 = snow 6-12" 7 = snow 12"
		53	
38-39	Unclassified goats (age & sex)	54-55	Observers initials
40-41	Drainage code	56	Data missing. If a 1 is entered computer will not consider entry.
42-44	Land type	57-58	Elevation. Eg:7800 = 78
45	Goat seen (1) or not seen (0)	59	Code data: 1 = prevented from locating 2 = no attempt to locate 3 = tried to locate but unsuccessful 4 = goat dead or collar retrieved 5 = nonspecific signal-could not pin down. (Enter code here if a 1 is entered in Col. 56).
46	Degrees F 3 = 20-40 1 = less than 0 4 = 40-60 2 = 0-20 6 = over 80		

Appendix 4. continued.

Column		Column	
60-61	Slope 1= 90% 2= 70-90% 3= 30-70% 4= 9-30% 5= 8%	67-68	Vegetation Type 1 crust 2 tundra 3 krummholz 4 short grass 5 parkland 6 forest 7 open 8 brush
62	Distance to escape terrain* 1 10 m (*cliffs, bluffs, 2 10-50 m cirque basins, 3 50-100 m broken) 4 over 100 m	69	Aspect 1 N 2 NE 3 E 4 SE 5 S 6 SW 7 W 8 NW 9 flat
63	Distance to timber 1 10 m 2 10-50 m 3 50-100 m 4 over 100 m		
64	Distance to road 1 = ¼ mi 2 = ¼ - ½ mi 3 = ½ - 1 mi 1 = over 1 mi		
65-66	Terrain Type 1 bluffs 2 cliffs 3 cirque basin 4 talus slope 5 broken 6 ridge 7 park 8 creek 9 sidehill		



Appendix 5. Mountain goats captured and marked on the East Front of the Rocky Mountains, 1979-1982.[1/]

DATE	LOCATION	SEX	AGE	FREQUENCY	COLOR/SYMBOL	EAR TAGS Right	EAR TAGS Left	COMMENTS
8/26/78	Mr. Frazier	?	Kid			A6046	A6047	
8/30/78	Mt. Frazier	M	Kid			J668	J669	Red Richey ear tag with black O
9/7/78	Mt. Frazier	M	Kid			A1452	A1453	Red Richey ear tag with black X
6/27/79	Mt. Frazier	F	3 yrs.	151.052	White w/black	A7477	A7476	Tranquilized w/24 mg succinyl choline chloride
7/14/79	Mt. Frazier	M	3 yrs.	151.185	Dark blue	A7493	A7494	Transmitter Nonfunctional 9/82
7/14/79	Mt. Frazier	M	2 yrs.		Black w/yellow	A7490	A7489	Recaptured 6/17/82
7/14/79	Mt. Frazier	M	2 yrs.		Black w/yellow	A7498	A7497	
7/23/79	Mt. Frazier	M	8 yrs.	150.723	Green	A7496	A7495	Transmitter Nonfunctional 11/81 Retrieved 5/30/83
8/27/79	Mt. Frazier	F	4 yrs.	151.082	White w/black stripes	A1455	A1454	Transmitter Nonfunctional 7/83
8/27/79	Mt. Frazier	F	4 yrs.	151.172	Black	A7492	A7491	
8/27/79	Mt. Frazier	M	kid			A7500	A7499	Orange plastic streamer in left ear Recaptured 7/15/82, Kid of 151.082
7/24/80	Our Lake	F	3 yrs.	151.222	Red	A7480	A7489	Transmitter Nonfunctional 5/83
7/24/80	Our Lake	M	1 yrs.	151.851	Black/white stripe	A6253	A6355	Dead goat located 8/13/82, collar & ear tag (A-6355) retrieved
7/24/80	Our Lake	M	kid			A7488	A7478	Yellow tag in right ear
7/10/81	Mt. Frazier	F	1 yrs.	151.526	White elastic			Radio retrieved 7/9/82
7/20/81	Mt. Frazier	F	1 yrs.	151.430	Black elastic	A10573		Recaptured 6/23/82 (150.551)
7/20/81	Mt. Frazier	M	1 yrs.	151.013	Red elastic	A6264	A6265	Recaptured 6/22/82 (150.539)
7/27/81	Mt. Frazier	F	1 yrs.	150.912	Green elastic		A10554	Transmitter Nonfunctional 11/81
7/27/81	Mt. Frazier	F	4 yrs.	151.814	Red Yellow	A10553		Recaptured 6/23/82 and 7/15/82

Continued on next page.

Appendix 5 continued.

DATE	LOCATION	SEX	AGE	FREQUENCY	COLOR/SYMBOL	EAR TAGS Right	EAR TAGS Left	COMMENTS
7/27/81	Mt. Frazier	M	3 yrs.	151.788	Yellow/red ☐		A10574	Transmitter Nonfunctional 3/82
6/17/82	Mt. Frazier	M	Adult	151.863	Yellow/black ☐	A9631	A9630	Right horn tip broken
6/17/82	Mt. Frazier	M	Adult	150.698	Blue/red ☐	A9628		Right horn broken
6/17/82	Mt. Frazier	M	Adult	Neckband	Black/yellow ◇	A7490	A7489	Captured 7/14/79
6/17/82	Mt. Frazier	M	Adult	150.340	Blue/yellow ☐			
6/17/82	Mt. Frazier	M	6 yrs.	150.567	Lt. blue/yellow stripe	A7498	A7494	Captured 7/14/79 (151.185-Blue PVC)
6/17/82	Mt. Frazier	M	3 yrs.	150.708	Green/red ☐	A9627	A9629	
6/22/82	Mt. Frazier	F	2 yrs.	150.531	Black elastic	A9636	A9637	Transmitter Nonfunctional 10/83
6/22/82	Mt. Frazier	M	2 yrs.	150.539	Yellow elastic	A8264	A8265	Captured 7/20/81, recaptured 7/15/82 (151.013-red elastic) Transmitter Non functional 9/83
6/22/82	Mt. Frazier	M	Adult	151.180	Green/yellow X	A9635	A9634	
6/22/82	Mt. Frazier	M	Adult	150.269	Black/blue ☐		A9632	
6/23/82	Mt. Frazier	F	2 yrs.	150.551	Yellow/red stripe elastic	A10573		Captured 7/20/81 (151.430-black elastic)
6/23/82	Mt. Frazier	M	2 yrs.	Neckband	Orange/white 2	A10540	A10539	
6/23/82	Mt. Frazier	F	5 yrs.	151.814	Yellow/red ═══	A10553		Captured 7/27/81, recaptured 7/15/82 Kid was not captured
7/15/82	Mt. Frazier	M	2 yrs.	150.539	Yellow elastic	A8264	A8265	Captured 7/20/81, recaptured 6/22/82 Transmitter Nonfunctional
7/15/82	Mt. Frazier	F	5 yrs.	151.814	Red / Yellow	A10553		Captured 7/27/81, recaptured 6/23/82 Died 10/82 Retrieved 12/82
7/15/82	Mt. Frazier	F	2 yrs.	150.551	Yellow w/red stripe	A10573		Captured 7/20/81, recaptured 6/23/82 Transmitter Nonfunctional 10/83

Continued on next page.

Appendix 5 continued.

DATE	LOCATION	SEX	AGE	FREQUENCY	COLOR/SYMBOL	EAR TAGS Right	EAR TAGS Left	COMMENTS
7/15/82	Mt. Frazier	M	kid	150.590	Blue w/green streamers	A9644	A9645	Transmitter Nonfunctional 7/83
7/15/82	Mt. Frazier	F	3 yrs.	150.492	Green elastic	A9643	A9642	Killed by hunter 10/10/82
7/15/82	Mt. Frazier	F	Adult	151.230	Yellow	A9649	A9648	
7/15/82	Mt. Frazier	F	2 yrs.	151.240	Light blue	A10535		One horn broken
7/15/82	Mt. Frazier	M	3 yrs.		Green w/white	A9641	A9640	Killed by Hunter 10/31/82
7/15/82	Mt. Frazier	M	3 yrs.		Orange w/white	A7500	A7499	Red plastic streamer in left ear from 8/27/79
7/15/82	Mt. Frazier	F	Adult		Blue w/white	A10530	A10538	
7/15/82	Mt. Frazier	F	5 yrs.		Red w/white	A10534	A10533	
7/15/82	Mt. Frazier	F	Adult	151.290	Black w/yellow stripe	A10527	A10526	Died 2/84 Retrieved 5/9/84

1/ Goats captured in 1978 and 1979 were handled by Mike Thompson, in 1980 by Doug Tomasko and in 1981 and 1982 by Gayle Joslin.

Appendix 6. Body measurements of eleven mountain goats captured at the Blackleaf lick site during June and July, 1981 and 1982.

Ear Tag No.		Sex/Age	Neck	Body	Shoulder	Chest	Rostrum	Beard	Ear	Horn Measurements			
										Length		Circumference	
Right	Left	in yrs.	Girth	Length	Height	Girth	Length	Length	Length	Right	Left	Right	Left
No tag		F/1	30.5[1]	88.9	63.5	71.1			10.2	10.2	10.2	7.6	7.6
	A10554	F/1	23.5	94.0	61.0	67.3	17.1[2]		10.2	10.2	10.2	7.0	7.0
A10573		F/1	26.7	99.1	66.0		17.1[2]		10.8	12.7	12.1	8.3	7.6
A10573		F/2	33.0		66.0		15.2[3]	7.6		15.2	15.2	8.3	8.3
A9643	A9642	F/3			73.7		15.2[3]			17.8	17.8	8.9	9.5
"	"									17.2[4]	18.4	10.2	9.5
A10553		F/4	33.0	119.4	83.2	96.5	24.8[2]		12.7	20.3	19.7	10.2	9.5
A10534	A10533	F/5	41.3		83.8		24.1[2]						
A6264	A6265	M/1	31.7	101.6	68.6		17.8[2]		10.8	14.0	12.7	8.9	7.6
A10540	A10539	M/2	43.2		76.2		15.2[3]	10.2		17.8	17.8	10.2	10.2
A7500	A7499	M/3	34.3		90.2		17.8[3]			21.6	21.0	12.1	12.1
A10530	A10538	M/3	39.4		92.7		20.3[2]	10.2					
A9641	A9640	M/3								20.3[5]	20.3	12.1	11.7
	A10574	M/3	35.6	96.5	71.1	87.6	19.4[2]		10.8	20.3	20.3	10.5	10.5

1 All measurements in centimeters.
2 Rostrum measured from end of nose to base of horns.
3 Rostrum measured from end of nose to corner of eye.
4 Measurements from harvested animal killed October 10, 1982.
5 Measurements from harvested animal killed October 31, 1982.

Appendix 7. Location and classification of mountain goats observed during helicopter survey of East Front, March 11 and 12, 1981.

Drainage	UTM Location	Total	Adult	Sub Adult	Kid	Uncl.
Mt. Poia	35160/533790	12	8	2	2	
Mt. Poia	35060/533830	4	2	1	1	
Family Pk	34940/533460	11	5	2	3	1
Mt Field	35310/533020	1	1			
Mt Richmond	35560/533350	6	4		2	
Mt. Sentinel	35710/533140	6	4	1	1	
Lost Horse	35270/532780	3	2		1	
M Fk Birch	35330/532690	1	1			
Mt Drewyer	35570/532750	5	5			
Crooked Mtn	35830/532970	13	5	1	3	4
Mt. Drewyer	35670/532630	3	2		1	
Pinto Cr	35600/532450	3	3			
Crazy Cr	35920/532250	3	2		1	
South Cr	36470/532310	2	2			
Hoy Gulch	36620/532290	1	1			
Walling Reef	36530/533050	2	2			
Walling Reef	36600/532920	2	1		1	
Ear Mtn	37360/529770	4	3		1	
N Fk Deep Cr	37350/529150	2	1		1	
Miners Basin	36720/529070	4	2	2		
Erosion Gulch	36930/528960	1	1			
Erosion Gulch	36820/529060	1	1			
No Business	37220/528740	4	2		1	1
Castle Reef	37220/528120	1	1			
Miners Basin	36670/529340	2	2			
Rocky Mtn	36450/529660	2	2			
Hdq Pass	36440/529870	15			4	11
Ray Cr	36230/529870	1	1			
Old Baldy	36390/530150	10	5		2	3
Choteau Mtn	37200/531020	11	8	1	2	
Mt Werner	37020/531770	2	1		1	
Mt Frazier	36950/531910	4	2		1	1
Fright Cr	36540/532060	6	4	1	1	
Old Man/Hills	36820/532240	5	4		1	
Old Man/Hills	36770/532350	5	3	1	1	
Bruce Cr	36230/531860	6	4		2	
Bruce Cr	36040/531960	2	2			
Bruce Cr	36040/531930	1	1			
Jones Cr	36750/531170	7	3	1	3	
Mt Wright	36230/531330	1	1			
Mt Lockhart	36310/531100	2	1		1	
N Fk Teton	36470/530580	2	2			

Appendix 8. Location and classification of mountain goats observed during helicopter survey of East Front, July 11, 12 and 18, 1981.

Drainage	UTM Location	Total	Adult	Sub Adult	Kid	Uncl.
Family Pk	35030/533510	3	1	1	1	
Mt Field	35330/533100	1				1
Mt Field	35240/533070	2	1	1		
Mt Drewyer	35780/532630	5	2	2		1
Pat Cass	35950/532200	1				1
Bum Shot	36150/532550	1	1			
Walling Reef	36720/532770	2				2
Walling Reef	36610/532870	1	1			
Walling Reef	36670/532650	6	2	1	1	2
Walling Reef	36670/532650	5	2		1	2
N Fk Dupuyer	36340/532270	2				2
Old Man/Hills	36830/532330	3	1	1		1
S Fk Dupuyer	36630/531960	6	2	2	2	
S Fk Dupuyer	36640/531940	2	1		1	
S Fk Dupuyer	36570/532010	7	2	3	1	1
Mt Werner	36900/531710	2	1	1		
Choteau Mt	37110/531400	2	1	1		
Choteau Mt	37130/531400	1	1			
Choteau Mt	37230/530930	9	4	3	2	
Pat Gass	36020/532070	1	1			
S Fk Nanny	36060/531950	1	1			
S Fk Nanny	36150/531870	2	1	1		
Mt Wright	36010/531480	2	2			
Mt Wright	36020/531480	3	3			
Mt Wright	36040/531470	2	2			
Mt Wright	36040/531470	1	1			
Mt Lockhart	36160/531030	7	5		2	
Waldron Cr	36240/530870	4	3		1	
Cave Mtn	36960/530690	2	1		1	
Cave Mtn	36970/530680	1		1		
Rocky Mtn	36580/529720	4	2		2	
Ear Mtn	37230/529930	1	1			
Limestone Cr	35030/533760	1	1			
Scar Face	34950/533770	4	1	2	1	
Scar Face	35050/533870	2	1	1		
Morning Star	34850/533930	2	1	1		
Scar Face	35050/533840	1	1			
Spotted Eagle	34620/533930	3	2		1	
Spotted Eagle	34620/533920	4	2		2	
Spotted Eagle	34610/533910	6	3	1	2	
Spotted Eagle	34610/533910	1	1			
Curly Bear	34530/534040	3	1	1	1	
Badger Cr	34760/534180	3	1	1	1	
Slim Gulch	37050/529460	2	1		1	
S Fk Teton	36750/529550	2	2			
S Fk Teton	36430/529890	9	8		1	

Appendix 9. Location and classification of mountain goats observed during helicopter survey of the East Front, April 1982.

Drainage	UTM Location	Total	Adult	Sub-adult	Kid	Uncl.
Birch Cr	3649/53333	2	2 M			
N Fk Birch	3543/53318	2	2			
N Fk Birch	3552/53325	7	2	2 Y	2	1
N Fk Birch	3565/53334	3	1	1 Y	1	
N Fk Dupuyer	3669/53255	1	1			
N Fk Dupuyer	3680/53247	1	1 M			
N Fk Dupuyer	3681/53230	1	1			
N Fk Teton	3676/53120	1	1 F			
E Fk N Fk Teton	3682/53157	2	1 F		1	
W Fk Teton	3622/53145	1	1 M			
M Fk Teton	3644/53026	2		2 Y		
S Fk Teton	3646/52984	14	5	2	5	2
Biggs Cr	3655/52947	6	2	2	2	
S Fk Willow Cr	3723/52993	5	2	1	2	

Appendix 10. Location and classification of mountain goats observed during helicopter survey of the East Front, July 1982.

Drainage	UTM Location	Total	Adult	Sub-adult	Kid	Uncl.
Badger-Limestone	3494/53397	4	2 F		2	
Badger Limestone	3498/53389	1	1		2	
S Fk Badger	3418/53420	1	1 F			
N Fk Badger	3405/53427	1	1 M			
N Fk Badger	3404/53427	3	1 F		2	
S Fk Badger	3413/53425	1	1			
S Fk Badger	3415/53407	2	1 F		1	
S Fk Badger	3451/53410	7	3, 2 F		2	
S Fk Badger	3454/53411	2	2 M			
Badger-Lonesome	3497/53392	1	1			
Badger-Lonesome	3459/53391	5	2, 1 F	1	1	
S Fk Badger	3492/53350	1	1 M			
N Fk Birch	3494/53348	6	1, 2 F	1	2	
N Fk Birch	3503/53345	9	5, 2 F		2	
M Fk Flathead	3503/53321	1	1 M			
N Fk Birch	3508/53326	4	1 F, 1 M	2		
N Fk Birch	3514/53330	1		1		
N Fk Birch	3515/53333	2	1 F		1	
N Fk Birch	3514/53325	1	1 M			
M Fk Flathead	3519/53316	2	2 M			
M Fk Birch	3532/53302	3	1, 1 F	1		
M Fk Birch	3551/53341	5	2 F	1	2	
M Fk Birch	3553/53338	4	2 F		2	
M Fk Birch	3567/53279	3	2	1		
M Fk Birch	3582/53298	3	1 F		2	
M Fk Birch	3556/53258	1	1			
M Fk Birch	3563/53251	3	1 F		2	
S Fk Birch	3594/53225	1	1 M			
N Fk Dupuyer	3667/53274	1	1			
N Fk Dupuyer	3663/53258	2	2 M			
N Fk Dupuyer	3668/53259	9	8	1		
N Fk Dupuyer	3668/53258	5	1, 1 F	2	1	
N Fk Dupuyer	3677/53238	1	1 M			
S Fk Dupuyer	3665/53194	3	1 F	1	1	
S Fk Dupuyer	3666/53191	2	1, 1 M			
S Fk Dupuyer	3669/53184	1		1		
S Fk Dupuyer	3689/53200	1	1			
S Fk Dupuyer	3695/53199	6	2, 1 F	2	1	
S Fk Dupuyer	3693/53197	1	1 F			
Blackleaf Cr	3696/53197	5	2, 1 F	1	1	
Muddy Cr	3683/53157	3	1, 1 F		1	
Muddy Cr	3708/53157	1	1 M			
Muddy Cr	3711/53141	1	1 M			
S Fk Teton	3718/53033	1	1 F			
S Fk Teton	3637/53008	2	1 F		1	
S Fk Teton	3638/53015	3	2	1		
S Fk Teton	3643/52996	4	1 M, 1 F	2		

Appendix 10 continued.

Drainage	UTM Location	Total	Adult	Sub-adult	Kid	Uncl.
S Fk Teton	3641/52991	4	1 F	2	1	
S Fk Teton	3653/52969	1	1 F			
S Fk Teton	3664/52970	2	1 F		1	
S Fk Teton	3678/53005	1	1 F			
S Fk Teton	3700/52985	1	1			
S Fk Teton	3707/52971	1	1			
N Fk Teton	3716/53127	2	1 F		1	
N Fk Teton	3713/53127	5	2 F	1	2	
N Fk Teton	3708/53129	4	3	1		
N Fk Teton	3711/53134	2	1, 1 M			
N Fk Teton	3712/53135	1	1 M			
N Fk Teton	3712/53137	2	1 F		1	
N Fk Teton	3629/53162	1	1			
N Fk Deep Cr	3744/52897	3	1 F	2		
N Fk Deep Cr	3726/52917	1	1 M			
N Fk Deep Cr	3717/52917	1	1 M			
N Fk Deep Cr	3733/52906	5	2 F	2	1	
S Fk Deep Cr	3723/52875	5	2 F	2	1	
Sun River	3718/52788	1	1			
Sun River	3672/52938	1	1 M			
Sun River	3646/52980	5	2 F	1	2	
Sun River	3619/52989	1	1 M			
Sun River	3635/53015	1	1 M			
Sun River	3595/53067	11	7, 1 F	2	1	

Appendix 11. Location and classification of mountain goats observed during helicopter survey of East Front, July 1983

Drainage	UTM Location	Total	Adult Male	Adult Female	Adult Unk	Sub Adult 1	Sub Adult 2	Sub Adult Unk	Kid	Uncl.
Steep Cr	35030/533740	1	1							
Steep Cr	35130/533690	2	1				1			
S Fk Badger	34540/534010	4		2					2	
Lonesome Cr	34560/533980	13		4	1			4	4	
Lonesome Cr	34550/534020	10		3	4			2	1	
Lonesome Cr	34560/534010	3		1				1	1	
S Fk Badger	34525/534110	6		2	1			1	2	
Lonesome Cr	34530/534470	1	1							
Lonesome Cr	34870/533950	2	2							
Lonesome Cr	34850/534050	1			1					
Limestone Cr	35000/533830	2		1				1		
S Fk Badger	34120/534250	5		3					2	
Kip Cr	34060/534280	2		1					1	
Kip Cr	33550/534350	3		1	1				1	
N Fk Birch	35140/533380	2		1					1	
Blind Cr	35130/533250	16		4	3			5	4	
Blind Cr	35250/533140	2		1					1	
Blind Cr	35250/533140	2		1				1		
Lost Horse Cr	35230/533060	1	1							
Lost Horse Cr	35160/532970	1	1							
Gateway Cr	35480/532490	1	1							
Nanny Cr	36020/532130	2			2					
Circus Cr	35940/532230	1	1							
Circus Cr	35980/532170	1			1					
Canyon Cr	36640/532640	2	2[1/]							
Sheep Cr	36600/532880	2		1	1					
N Fk Dupuyer	36680/532580	2	1			1				
N Fk Dupuyer	36670/532550	1						1		
N Fk Dupuyer	36690/532640	1		1						
N Fk Dupuyer	36770/532660	2		1					1	
N Fk Dupuyer	36320/532330	1	1							
S Fk Dupuyer	36800/532350	5		2	1				2	
Rival Cr	36650/531950	1		1[2/]						
Rival Cr	36650/531960	1		1						
Rival Cr	36640/531990	1	1							
S Fk Dupuyer	36950/531990	5		3[3/]	1		1			
Nanny Cr	36030/532140	2			2					
Bruce Cr	36120/531870	4			3			1		
Bruce Cr	36220/531880	2		1				1		
Bruce Cr	36210/531870	1		1						
Bruce Cr	36120/531860	1	1							
Bruce Cr	36100/531810	1			1					
Jones Cr	37040/531410	1			1					
Jones Cr	37050/531420	1		1[4/]						
Bruce Cr	36190/531450	1	1							

Appendix 11. continued

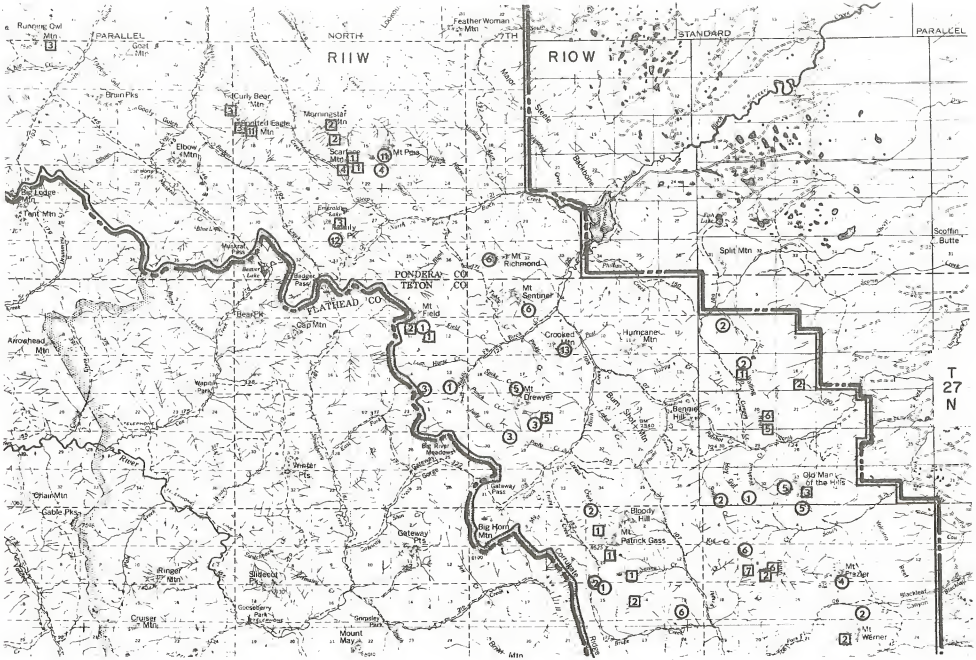
Drainage	UTM Location	Total	Adult Male	Adult Female	Adult Unk	Sub Adult 1	Sub Adult 2	Sub Adult Unk	Kid	Uncl.
W Fk Teton	35980/531490	1			1					
M Fk Teton	36370/530160	2			2					
Route Cr	36340/530150	1			1					
S Fk Teton	36440/530170	1			1					
S Fk Teton	36450/530170	2	2							
Nesbit Cr	35925/530630	6		3				1	2	
Headquarters	36390/529870	15		5	3			3	4	
South Cr	36640/529650	9		4[5/]	2			3		
South Cr	36640/529760	1			1					
South Cr	36620/529750	2			2					
S Fk Teton	36620/529810	1			1					
South Cr	36730/529540	1			1					
S Fk Willow	37230/529750	8		3	1	2			2	
N Fk Deep	37380/529070	1		1						
N Fk Deep	37170/529160	2		1				1		
No Business	37120/528590	1	1							
S Fk Deep	37240/528720	4			2			2		
Ray Cr	36080/529830	2		2						
Ray Cr	36190/529880	2			2					
Total		184	19	57	44	3	2	28	31	

[1/] Radio collar 7881, 5 year male
[2/] Neckband blue and white no. 32, adult female
[3/] Neckband red and white no. 42, 6 year female, radio collar 2302, adult female; radio collar 2402, 3 year female
[4/] Radio collar 2902, adult female
[5/] Radio collar 2202, adult female

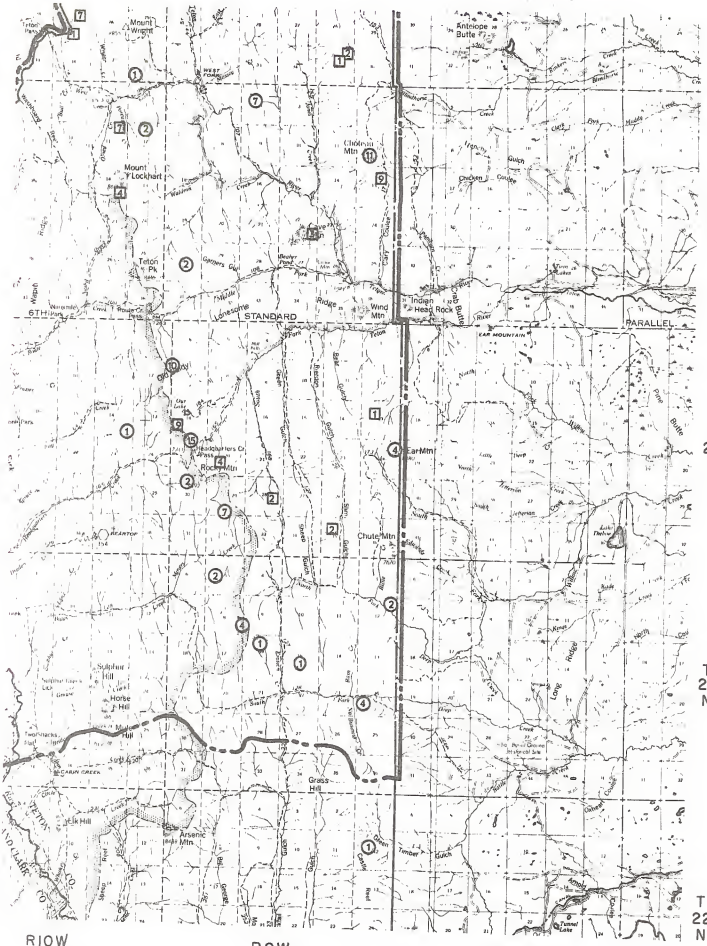
Appendix 12. Location and classification of mountain goats observed during helicopter survey of North Fork Dupuyer to South Fork Teton portion of the East Front, April 30 and May 1, 1984

Drainage	UTM Location	Total	Adult			Sub Adult				
			Male	Female	Unk	1	2	Unk	Kid	Uncl.
Sheep Cr	36520/533270	2	2							
Scoffin Cr	36690/532830	1			1					
Canyon Cr	36670/532590	1	1							
N Fk Dupuyer	36770/532430	1		1						
S Fk Dupuyer	37060/532280	3		2[1/]					1	
Cow Cr	37170/532080	1	1[2/]							
Muddy Cr	37070/531640	1	1[3/]							
Blackleaf Cr	37290/531790	1	1							
Blackleaf Cr	36960/531730	2		1[4/]			1			
Blackleaf Cr	36940/531720	2		2[5/]						
Muddy Cr	37080/531480	1	1[6/]							
Jones Cr	37130/531240	1		1						
Jones Cr	37090/531260	3		1		1			1	
Jones Cr	36790/531160	1		1						
E Fk Teton	36630/531930	1	1[7/]							
Nanny Cr	36120/532120	2	2							
Bruce Cr	36100/531800	4	1	2		1				
N Fk Teton	36330/531490	5	1	3		1				
M Fk Teton	36380/530450	8		5		2			1	
S Fk Teton	36480/530220	5		3		1			1	
S Fk Teton	36540/530000	1			1					
S Fk Teton	36440/529850	11		7		1	1		2	
S Fk Teton	36450/529860	2	2							
Total		60	14	29	2	7	2		6	

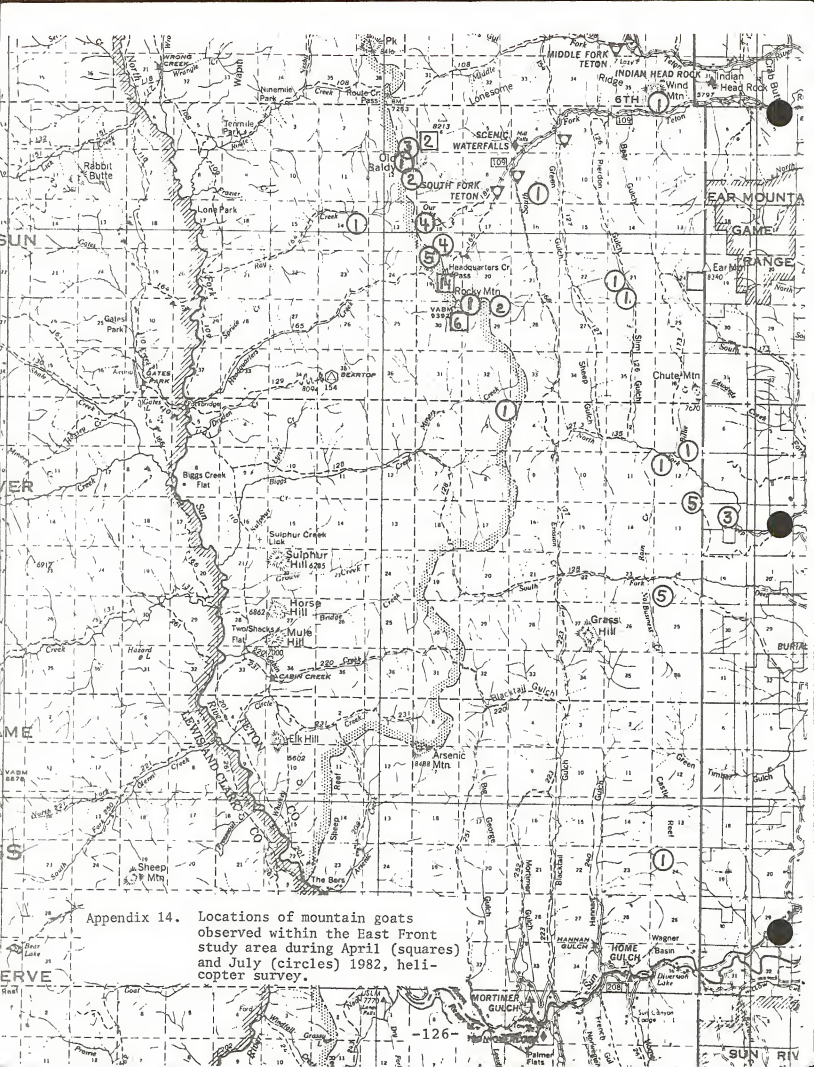
[1/] Neckband blue and white no. 32 adult female
[2/] Radio collar 8612 adult male
[3/] Radio collar 2692 adult male
[4/] Radio collar 2302 adult female
[5/] Radio collar 2402, 3 year female and neckband red and white no. 42, 6 year female
[6/] Radio collar 7082 adult male
[7/] Neckband black and yellow no. 19, 6 year male



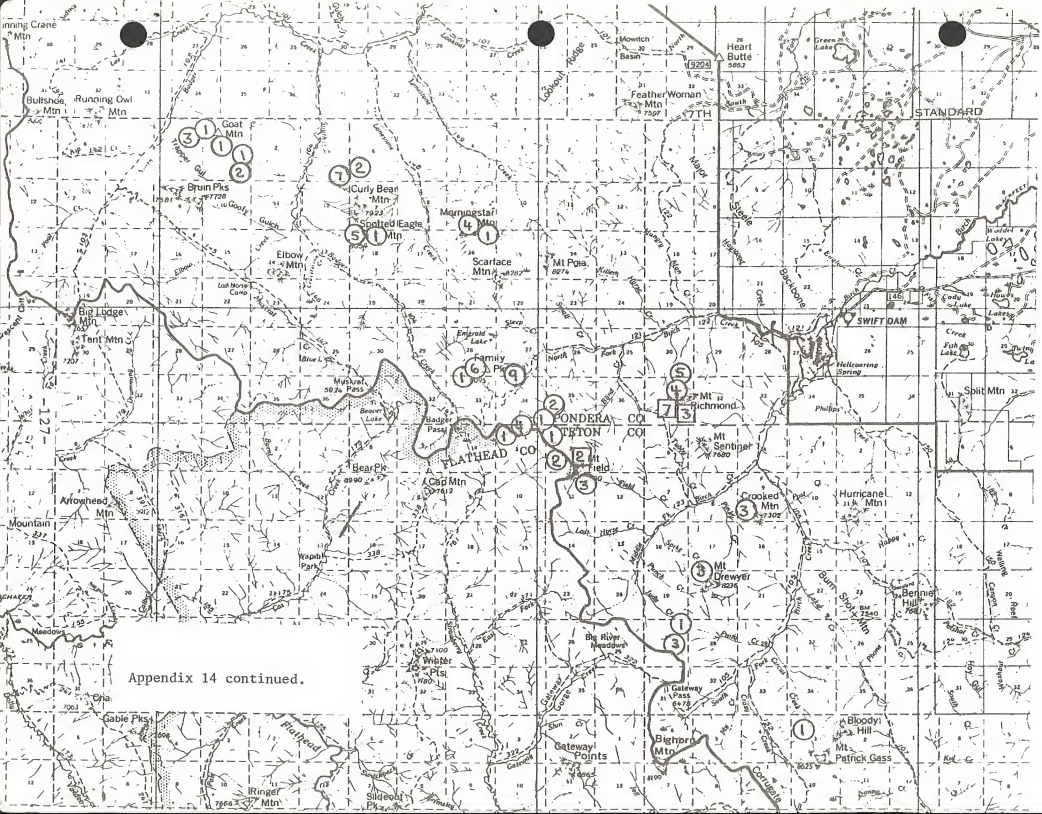
Appendix 13. Locations of mountain goats observed within the East Front study area during the March (circles) and July (squares) 1981, helicopter surveys.

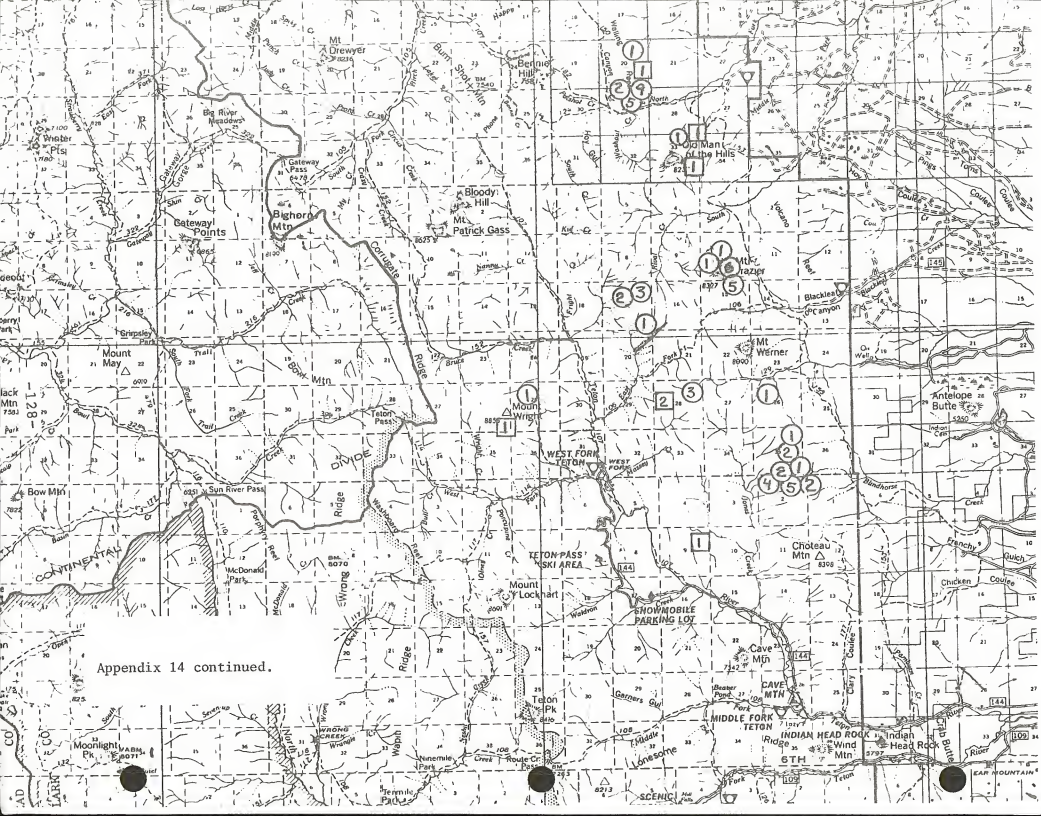


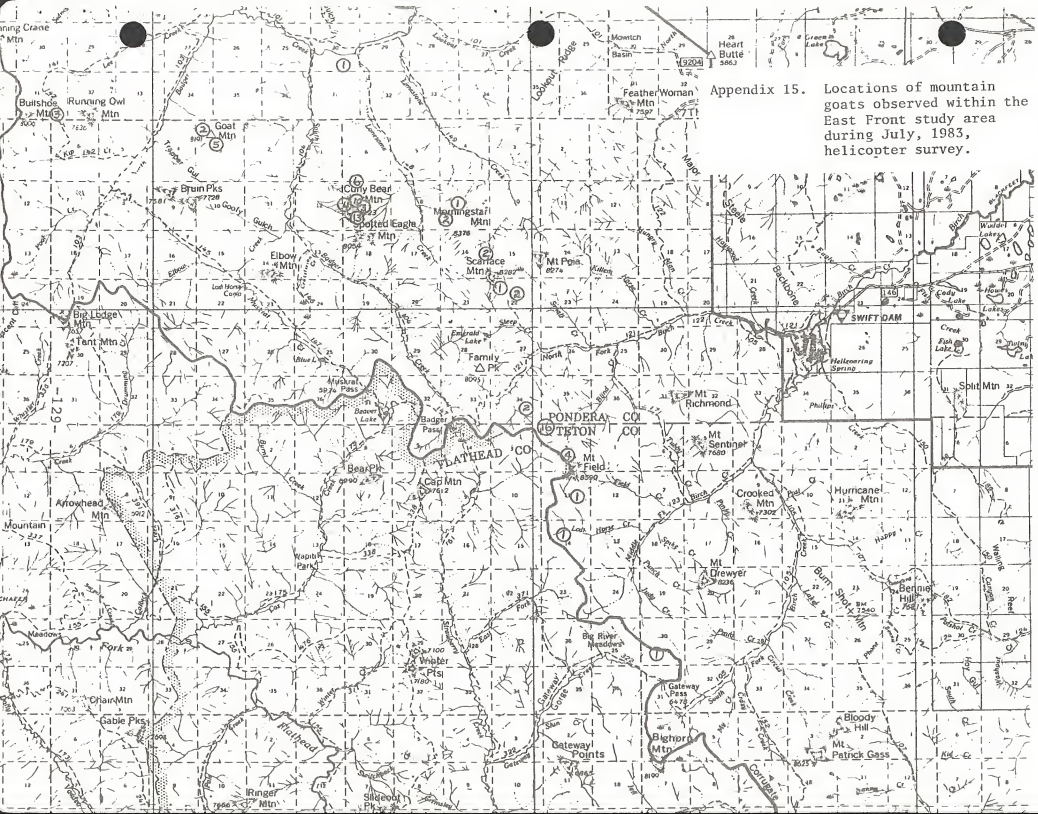
Appendix 13 continued.



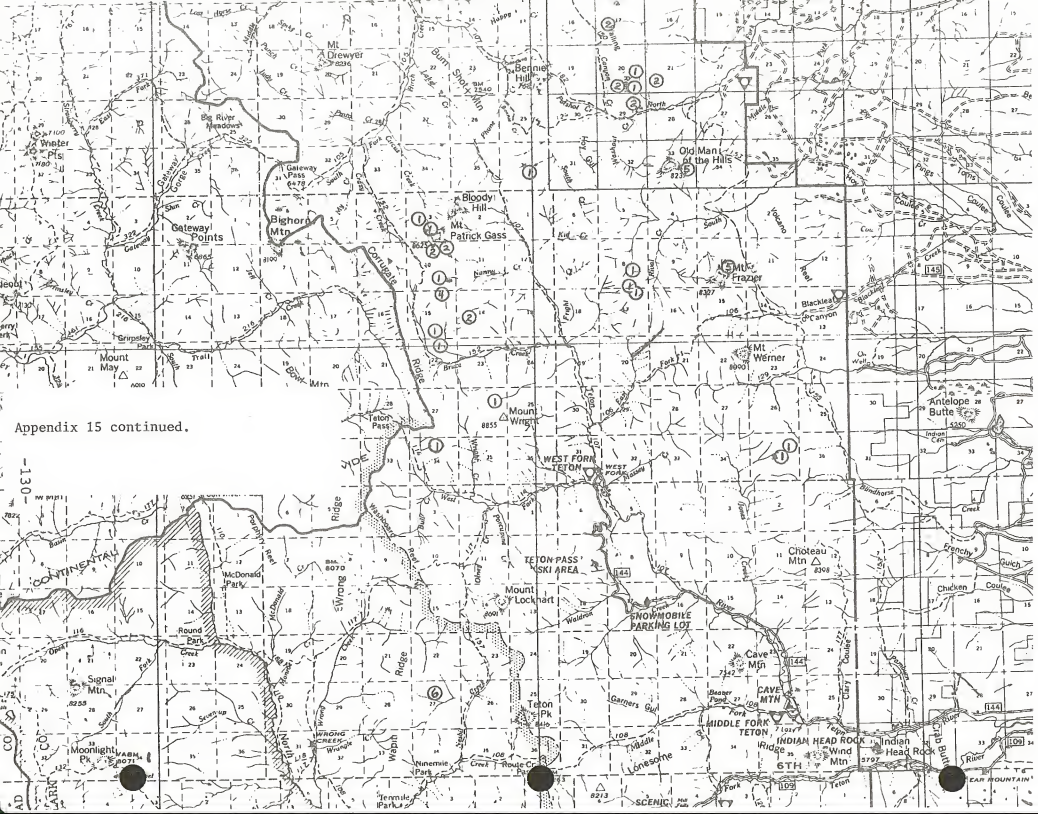
Appendix 14. Locations of mountain goats observed within the East Front study area during April (squares) and July (circles) 1982, helicopter survey.


Heart Butte 5863
Feather Woman Mtn 7307
STANDARD
Bullshoe Mtn
Running Owl Mtn
Goat Mtn
Bruin Pks 7728
Curly Bear Mtn
Spotted Eagle Mtn
Morningstar Mtn
Elbow Mtn
Scarface Mtn
Mt Poia 8874
SWIFT DAM
Big Lodge Mtn
Tent Mtn
Family Pk
Mt Richmond
Split Mtn
Mt Sentinel
FLATHEAD CO
BONDERA CO
TETON CO
Bear Pk 8990
Cap Mtn 7612
Crooked Mtn
Hurricane Mtn
Arrowhead Mtn
Mountain
Mt Drewyer
Bernie Hill
Big River Meadows
Gateway Pass 6478
Bloody Hill
Mt Patrick Gass
Gateway Points
Bighorn Mtn
Gable Pks
Ringer Mtn
Skyland Pk
Appendix 14 continued.

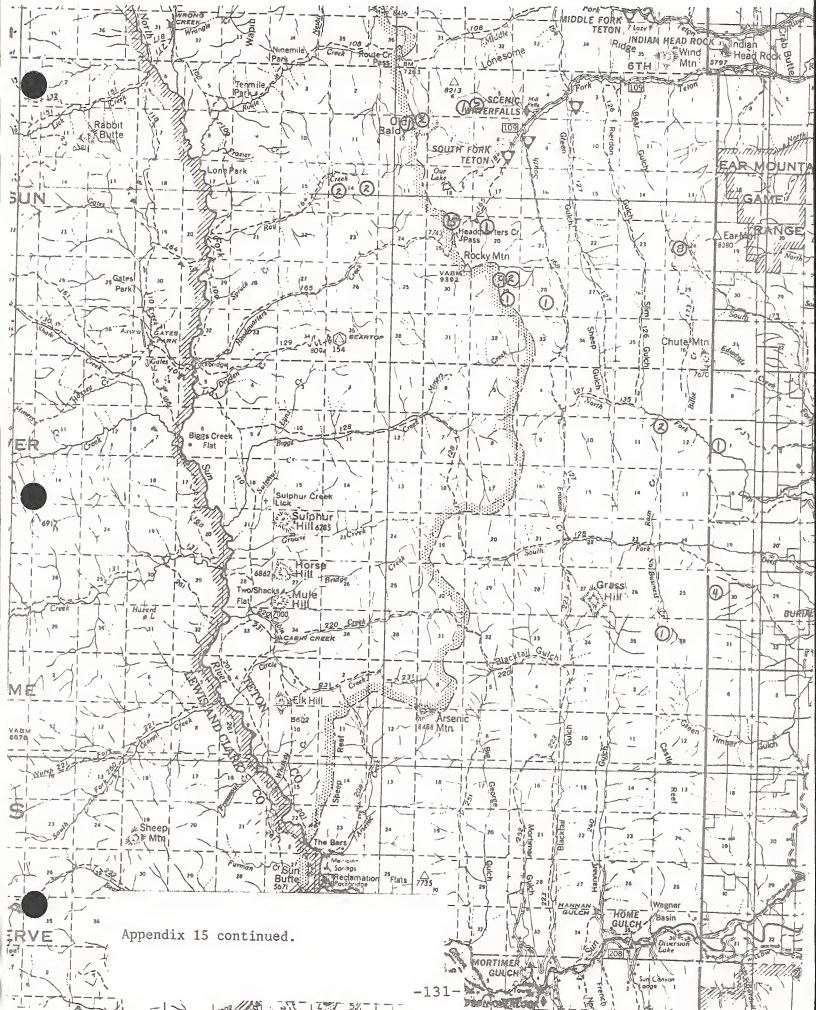

Mt Drewyer
Bernie Hill
Old Man of the Hills
Webb Pk
Big River Meadows
Gateway Pass
Gateway Points
Bighorn Mtn
Bloody Hill
Mt Patrick Gass
Mt Hazier
Blackleaf Canyon
Mt Werner
Antelope Butte
Mount May
Bowl Mtn
Teton Pass
Mount Wright
WEST FORK TETON
DIVIDE
Bow Mtn
Sun River Pass
McDonald Park
CONTINENTAL
TETON PASS SKI AREA
Mount Lockhart
SNOWMOBILE PARKING LOT
Choteau Mtn
Cave Mtn
CAVE MTN
MIDDLE FORK TETON
INDIAN HEAD ROCK
Indian Head Rock
Wind Mtn
Teton Pk
Moonlight Pk
Route Cr
Lonesome
SCENIC
Appendix 14 continued.

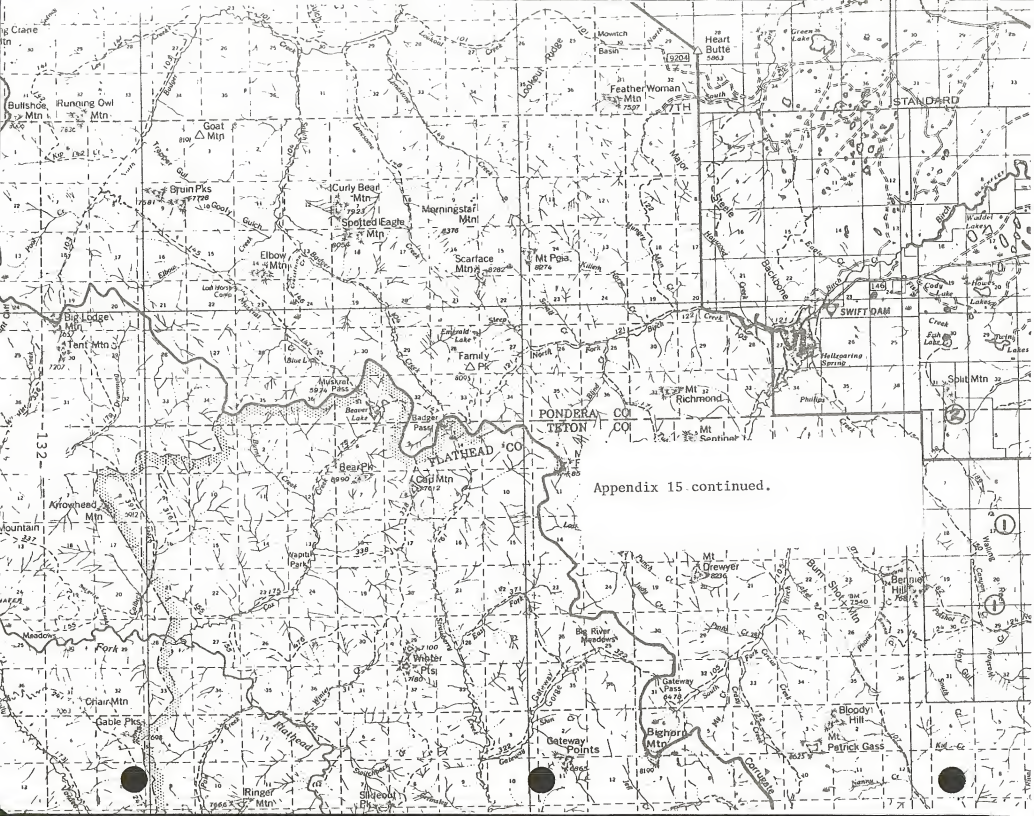


Appendix 15. Locations of mountain goats observed within the East Front study area during July, 1983, helicopter survey.

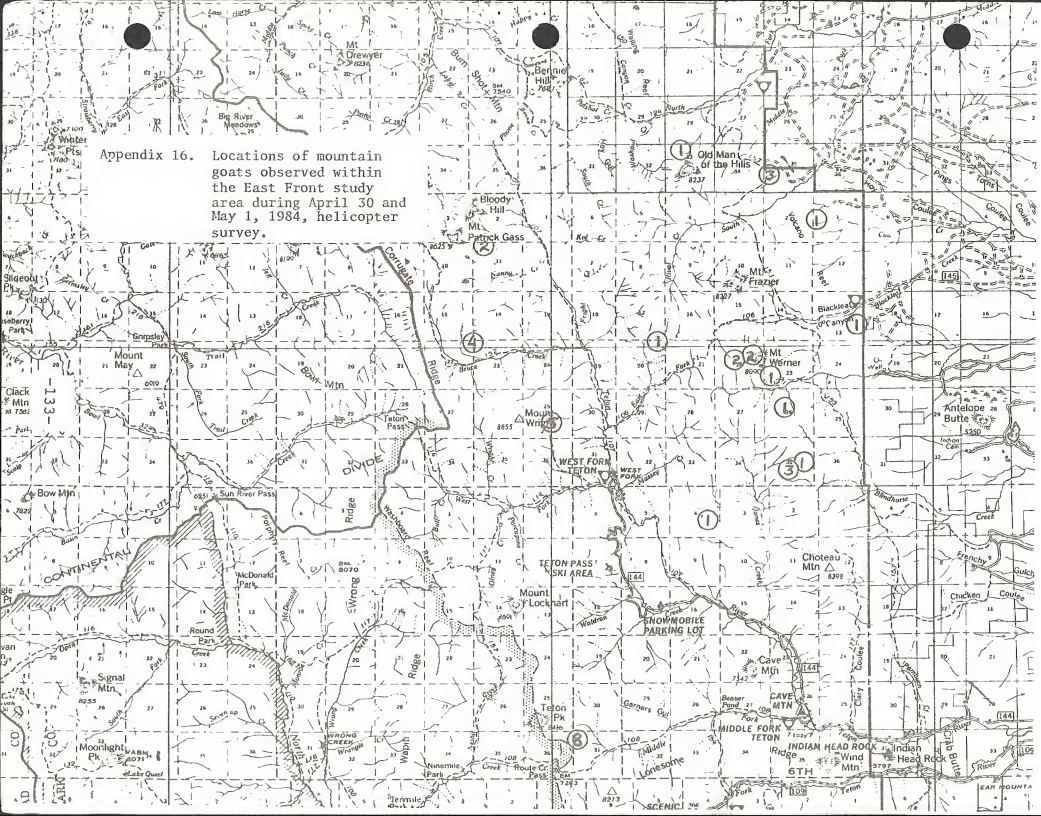


Appendix 15 continued.

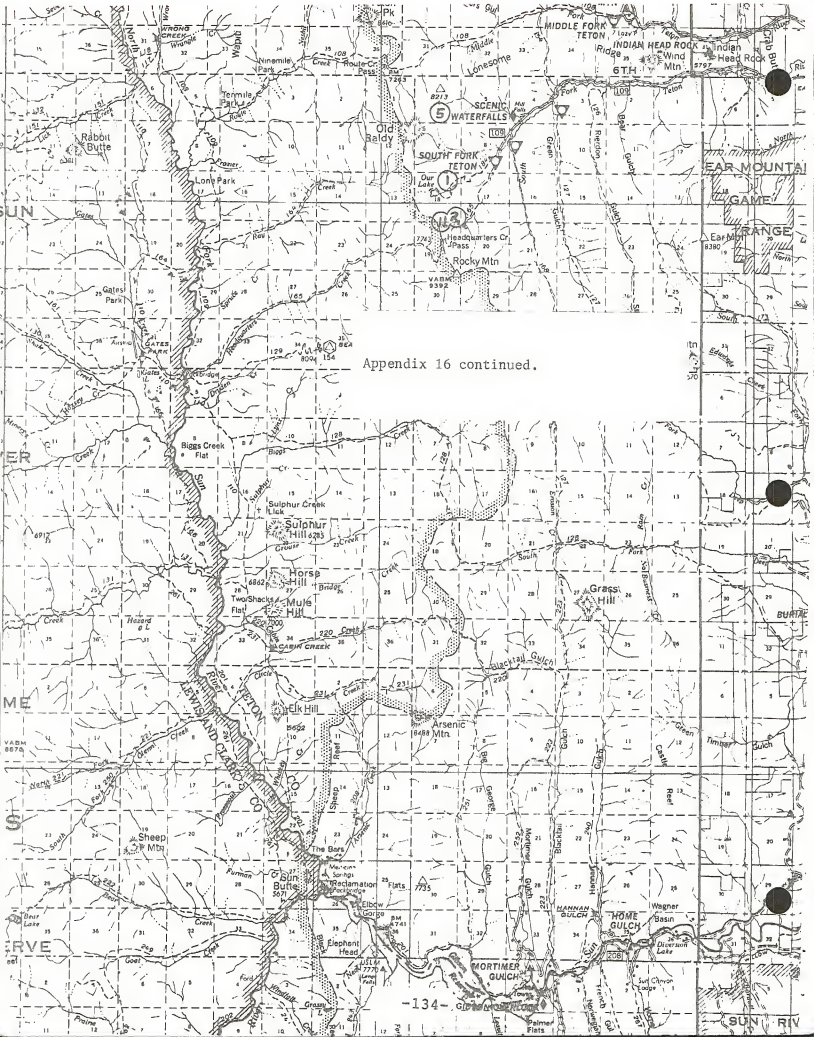

MIDDLE FORK TETON
INDIAN HEAD ROCK
Indian Head Rock
Wind Mtn.
6TH
Lonesome
Old Baldy
SCENIC WATERFALLS
SOUTH FORK TETON
Our Lake
Headquarters Cr Pass
Rocky Mtn
Rabbit Butte
Long Park
Gates Park
Bigg Creek Flat
Sulphur Creek
Sulphur Hill
Horse Hill
Two Shacks Flat
Mule Hill
Elk Hill
Arsenic Mtn
Sheep Mtn
Sun Butte
The Bars
Chute Mtn
Grass Hill
Blackfoot Gulch
HOME GULCH
MANNAN GULCH
MORTIMER GULCH
Wagner Basin
Diamond Lake
Palmer Flats
Sun Canyon Lodge
Reclamation Plantation
Appendix 15 continued.



Appendix 15 continued.



Appendix 16. Locations of mountain goats observed within the East Front study area during April 30 and May 1, 1984, helicopter survey.


Appendix 16 continued.
MIDDLE FORK TETON
INDIAN HEAD ROCK
Indian Head Rock
Wind Mtn
6TH
SCENIC WATERFALLS
Old Baldy
SOUTH FORK TETON
Our Lake
Headquarters Cr Pass
Rocky Mtn
Ninemile Park
Tennile Park
Rabbit Butte
Lone Park
Gates Park
Bigg Creek Flat
Sulphur Creek
Sulphur Hill
Horse Hill
Two Shacks Flat
Mule Hill
CABIN CREEK
Elk Hill
Arsenic Mtn
Sheep Mtn
Sun Buttes
Reclamation
Elephant Head
MORTIMER GULCH
HANNAH GULCH
HOME GULCH
Wagner Basin
Grass Hill
Earl Mtn
GAME RANGE
EAR MOUNTAI
SUN RIV
-134-

Appendix 17. Location and description of mountain goat feeding sites examined during 1981.

DATE		LOCATION T	R	S	DRAINAGE	ELEVATION (Feet)	ASPECT
March	15	26N	10W	25	W Fk, N Fk Teton	7450	SW
	15	26N	10W	25	W Fk, N Fk Teton	7400	SW
	16	25N	9W	12	Jones Cr	8200	SW
	28	25N	9W	14	Jones Cr	7700	W
	28	25N	9W	14	Jones Cr	7650	S
April	2	25N	9W	34SW	S Fk Teton	6000	SW
	2	25N	9W	34SW	S Fk Teton	6100	SW
	11	25N	9W	26	M Fk Teton	6400	E
	30	26N	9W	10	Blackleaf Cr	6600	SE
May	23	25N	9W	34SW	S Fk Teton	6400	S
	24	26N	9W	10	Blackleaf Cr	6400	SE
	25	26N	9W	10	Blackleaf Cr	6600	SE
	25	26N	9W	11	Blackleaf Cr	6900	SE
	25	26N	9W	10	Blackleaf Cr	6300	S
June	2	27N	9W	35SE	S Fk Dupuyer	6200	SE
	5	26N	9W	14NW	Blackleaf Cr	6000	SE
	5	26N	9W	15	Blackleaf Cr	6400	SE
	5	26N	9W	10	Blackleaf Cr	6800	E
	22	25N	9W	7SW	Frenchy Gulch	6800	SE
July	5	25N	9W	1	Blindhorse	7700	E
	5	25N	9W	1	Blindhorse	7700	E
	22	24N	9W	20SW	S Fk Teton	7200	E
	22	24N	9W	20NW	S Fk Teton	7000	NE
	27	26N	9W	10	Blackleaf Cr	6800	E
August	19	26N	9W	15NW	Blackleaf Cr	7200	SE
	20	24N	9W	19	Headquarters Cr	7700	N
	20	24N	9W	19	S Fk Teton	7700	E
	21	27N	9W	21NW	N Fk Dupuyer	7500	N
	21	27N	9W	21NW	N Fk Dupuyer	7500	E
September	11	25N	9W	7SW	Frenchy Gulch	6600	SE
	11	25N	9W	12	Frenchy Gulch	7400	NE
	26	26N	9W	10	Blackleaf Cr	7000	E
	26	26N	9W	10	Blackleaf Cr	7500	E
	26	26N	9W	10	Blackleaf Cr	7000	E

Appendix 18. Average percent frequency and cover of general vegetation classes from five mountain goat feeding sites during March through September, 1981.

	March	April	May	June	July	August	September
Bare Ground	6.6/0.3[1]	14.9/1.0	54.7/7.8	70.7/11.6	58.7/9.5	34.7/4.5	54.7/9.3
Grass	60.0/1.8	60.0/7.2	77.3/14.8	84.0/16.3	89.3/13.7	61.3/3.6	88.0/15.8
Forbs	56.0/2.9	91.7/3.8	97.3/7.3	100.0/21.2	100.0/35.7	100.0/32.0	98.7/39.1
Shrubs	37.3/7.8	80.0/30.6	78.7/27.3	60.0/16.2	13.3/3.4	16.0/3.7	26.7/6.7
Rock	97.3/54.4	60.0/19.8	68.0/16.1	82.7/22.9	65.3/17.4	94.7/37.2	70.6/22.9
Sedge	17.3/0.4	23.3/3.3	20.0/0.6	16.0/1.1	18.6/1.0	49.3/5.6	29.3/4.4
Lichen	4.0/Tr[2]	1.7/Tr	13.3/0.1	2.7/Tr	6.7/Tr	8.0/0.2	6.6/0.4
Litter	45.3/13.3	70.0/11.2	70.0/9.3	52.0/6.1	64.0/6.8	77.3/19.0	97.3/29.9
Moss (Snow)		30.0/1.4	30.6/1.0	10.7/1.8	24.0/3.5	28.0/0.8	14.6/3.5

1/ Frequency (occurrence in 15-2X5 dm frames)/average cover (average of cover categories in 15 frames).

2/ Tr = trace, less than 0.1 percent.

Appendix 19. Average percent frequency and cover of plant species from five mountain goat feeding sites measured each month from March through September, 1981

Trees	March	April	May	June	July	August	September
Abies lasiocarpa	X[1]				6.6/1.0[2]	5.3/0.7	X
Picea							X
*[3]*Pinus albicaulis*		1.7/Tr[4]	1.3/Tr	X	X	X	
* *Pinus flexilus*	6.6/1.1	3.3/1.1	2.6/0.9	4.0/0.3	X	2.6/0.2	1.3/0.2
Pseudotsuga menziesii	1.3/Tr	X	4.0/0.2	1.3/0.5			X
Shrubs							
* *Acer glabrum*		3.3/Tr		1.3/0.8			1.3/Tr
Amelanchier alnifolia			5.3/Tr	8.2/0.5			X
* *Arctostaphylos uva-ursi*	26.6/3.8	36.7/13.8	46.7/20.1	9.3/3.9	8.0/2.3	X	1.3/0.5
* *Berberis repens*		28.3/0.2	4.0/Tr	2.7/Tr			2.6/0.4
* *Juniperus communis*	6.6/2.5	10.0/4.3	1.3/0.5	12.0/3.3	1.3/0.8	4.0/2.1	
* *J. horizontalis*		10.0/2.0	4.0/0.5				
J. scopulorum		1.7/0.2			1.3/Tr		
Lonicera utahensis							
Penstemon fruticosus				6.7/Tr			
Philadelphus lewisii		1.7/Tr					8.0/2.8
Potentilla fruticosa	14.6/2.6	25.0/2.7	8.0/3.3	9.3/3.0	5.3/Tr	9.3/0.6	8.0/1.5
Prunus virginiana		1.7/Tr	2.7/Tr	5.3/0.5			
Ribes sp.				X	X	1.3/Tr	
* *Rosa sp.*		30.0/0.2	45.3/0.2	40.0/1.4	4.0/0.2		
Rubus idaeus							4.0/0.7
R. parviflorus					1.3/Tr		
* *Salix sp.*						X	
S. artica		1.7/Tr	4.0/Tr				
* *Shepherdia canadensis*	1.3/Tr	20.0/5.1	6.7/2.2	2.6/0.7		2.7/0.7	5.3/0.8
Spiraea betulifolia					5.3/0.1		
Symphoricarpos albus				2.7/Tr			X

Appendix 19 continued.

Forbs	March	April	May	June	July	August	September
Achillia millefolium	1.3/Tr	18.3/Tr	18.6/Tr	29.3/0.4	66.7/2.6	30.7/1.3	49.3/3.5
Agoseris sp.			8.0/Tr	9.3/0.5	4.0/Tr		
* *A. glauca*				1.3/Tr	9.3/0.4	13.3/0.7	8.0/1.1
Androsace sp.	1.3/Tr						
A. lehmanniana	25.3/0.1			X	16.0/1.0	37.3/1.2	21.3/1.6
A. septentrionalis				X	24.0/0.2		
Angelica sp.							2.3/0.4
* *Anemone multifida*		8.3/Tr	17.3/0.2	5.3/0.6	5.3/0.4		13.3/0.8
A. nuttalliana		1.7/Tr		X			
* *A. parviflora*					33.3/3.5	17.3/1.4	1.3/Tr
Antennaria sp.	1.3/Tr		18.7/1.2	2.7/Tr	5.3/0.5		6.7/0.2
A. alpina		3.3/0.6	4.0/Tr	17.3/2.6	6.7/0.1	6.7/0.3	21.3/2.1
A. microphylla	1.3/Tr				9.3/1.4	4.0/Tr	
A. racemosa					6.7/0.5	1.3/Tr	
* *Aquilegia flavescens*						1.3/Tr	
A. jonesii			1.3/Tr	8.0 Tr	6.6/Tr	2.7/Tr	
Arabis sp.			4.0/Tr				
A. nuttallii	1.3/Tr		8.0/0.1		32.0/2.22	X	8.0/0.8
Arenaria sp.				4.0/Tr	6.7/0.3	5.3/0.1	
A. capillaris				17.3/0.5			
A. congesta			6.7/Tr	1.3/Tr			
A. hookeri						2.6/0.2	5.3/0.6
A. obtusiloba						10.7/0.9	
* *A. rossii*							
A. rubella	6.6/Tr				5.3/0.3		
* *Arnica sp.*							2.6/Tr
A. alpina			2.7/Tr	1.3/Tr	12.0/0.6	8.0/1.3	2.6/0.2
* *A. cordifolia*					4.0/0.3		
A. latifolia							1.3/0.5
A. longifolia					2.7/Tr		
A. rydbergii							
* *Artemesia michauxiana*							10.7/1.6
Aster sp							1.3/Tr

Appendix 19 continued.

Forbs continued.	March	April	May	June	July	August	September
* *A. alpigenus*						6.7/0.5	
* *A. foliaceus*				1.3/Tr	6.7/0.5	6.7/0.6	2.6/0.4
* *A. integrifolius*					2.7/0.2		
* *A. occidentalis*						12.0/1.3	
A. sibericus					1.3/Tr		
Astragalus sp.		X	1.3/Tr		10.7/1.0	14.7/3.1	37.3/5.4
A. alpinus					18.7/0.5		
* *A. bourgovii*			1.3/Tr	4.0/Tr	44.0/5.4	26.7/2.0	
A. miser			X				
A. vexilliflexus				8.0/0.2			
Balsamorhiza sagittata				1.3/Tr			
Besseya wyomingensis			5.3/Tr	9.3/Tr	2.6/Tr		
Boraginaceae					X		
* *Bupleurum americanum*		13.3/Tr	16.0/0.2	2.6/Tr	2.6/Tr	6.7/Tr	10.7/0.6
Campanula rotundifolia						10.3/0.1	8.0/0.2
Castilleja sp.				18.7/0.4	2.6/0.4	2.6/0.4	2.3/0.2
* *C. rhexifolia*					1.3/0.2	2.6/0.2	6.7/0.8
Cerastium arvense			1.3/Tr	13.3/0.2	2.6/Tr		10.7/0.9
C. berringianum			4.0/Tr			12.0/0.6	10.6/0.7
C. vulgatum				17.3/0.2	4.0/Tr		
Cirsium sp.	1.3/Tr				13.3/1.8	5.3/Tr	18.7/2.3
Claytonia megarhiza							X
Clematis sp.		X		X	1.3/Tr		4.0/0.3
C. pseudoalpina				1.3/Tr			
Collinsia parviflora	X			28.0/0.2	18.7/0.7		
* *Comandra umbellata*			1.3/Tr	2.6/Tr			
Compositae	2.6/Tr	8.3/Tr	6.7/Tr	14.7/1.0	5.3/0.1		5.3/0.6
Cruciferae			1.3/Tr	X	10.7/Tr	1.3/Tr	5.3/Tr
Douglasia montana	1.3/Tr	1.7/Tr	10.7/0.3		5.3/0.6		
Draba lonchocarpa		1.7/Tr		X			
D. oligosperma		5.0/Tr	1.3/Tr	1.3/Tr			1.3/0.2
D. paysonii					1.3/Tr		
Dryas octopetala	2.6/Tr				4.0/1.7	42.7/13.8	14.7/7.1
Epilobium alpinum				1.3/Tr			

Appendix 19 continued.

Forbs continued.	March	April	May	June	July	August	September
* *E. angustifolium*			5.3/Tr	2.6/Tr	8.0/0.4		4.0/0.3
* *Erigeron sp.*					2.6/Tr		2.7/0.4
E. compositus	12.0/2.7	13.3/Tr	5.3/Tr	4.0/Tr		2.6/Tr	1.3/Tr
E. grandiflorus						1.3/Tr	
* *E. humilus*				5.3/Tr			
E. lanatus						16.0/2.2	
E. peregrinus							10.7/0.8
E. pumilus		5.0/Tr	8.0/Tr	2.6/0.2			
E. simplex					6.7/Tr		
E. speciosus					X	X	
* *Eriogonum sp.*		3.3/0.3	9.3/0.1	10.6/0.7			X
E. flavum					1.3/0.2	1.3/Tr	
E. ovalifolium	8.0/Tr			1.3/Tr	2.6/Tr	4.0/0.2	
* *E. umbellatum*				4.0/Tr	X		2.7/0.2
Erythronium grandiflorum		1.7/Tr		1.3/Tr			
* *Fragaria virginiana*		20.0/0.2	10.6/0.1	9.3/0.2	16.0/1.4	4.0/0.1	24.0/2.9
Frasera speciosa						1.3/0.2	12.0/2.1
* *Gaillardia aristata*				2.6/Tr	8.0/0.7	5.3/0.4	
Galium boreale	4.0/Tr	43.3/0.2	17.3/0.1	18.6/1.0	22.7/1.4	22.7/1.2	49.3/4.9
G. trifidum							1.3/0.2
G. triflorum			6.7/0.8	1.3/0.2			8.0/0.5
* *Gentiana calycosa*					6.7/0.4	6.7/1.1	
Geranium viscosissimum				X	X		
Geum sp.							5.3/0.1
Hackelia floribunda							X
* *Haplopappus sp.*				X			
H. lyallii					12.0/1.0	4.0/0.4	
* *Hedysarum sp.*				4.0/Tr		24.0/2.2	
H. alpinum					2.6/Tr		
H. sulphurescens					2.6/0.4		
Heracleum lanatum					1.3/0.2		5.3/0.6
Heuchera sp.	1.3/Tr	1.7/Tr	6.7/0.4	9.3/0.2			X
H. parvifolia	2.7/0.2						1.3/Tr

Appendix 19 continued.

Forbs continued	March	April	May	June	July	August	September
* *Hieracium sp.*					1.3/0.2		
H. cynoglossoides				5.3/0.4			
Hydrophyllum capitatum				12.0/0.2	1.3/Tr		
Leguminosae						4.0/0.4	
Linum perenne				2.6/Tr			1.3/0.2
Lithospermum ruderale			X	1.3/0.2	2.7/6.6		
Lloydia serotina			1.3/Tr	1.3/0.2		14.7/0.2	5.3/Tr
Lomatium sp.							
L. cous				8.0/0.1			
* *L. dissectum*			2.7/Tr	X			
L. triternatum		1.7/Tr		1.3/Tr			
Lupinus sp.			20.0/0.3	10.7/0.7	14.7/2.9		10.7/1.1
Mertensia oblongifolia					2.6/0.2		
Mitella breweri					X		1.3/0.2
Monarda fistulosa		1.7/Tr	6.7/Tr	8.0/0.7		2.6/Tr	
Myosotis sylvatica					4.0/0.1		
Osmorhiza occidentalis				1.3/Tr			
Oxytropis besseyi						16.0/0.5	
* *O. sericea*				2.6/Tr			8.0/0.7
Parnassia fimbriata					1.3/Tr		
Pedicularis sp.	X						
P. bracteosa	5.3/1.1				X		
* *P. contorta*			5.3/Tr	1.3/Tr	8.0/0.8	2.6/0.2	2.6/0.2
P. racemosa					1.3/0.2		
* *Penstemon sp.*	4.0/Tr	10.0/0.3	1.3/Tr	6.7/0.5	2.6/0.2	9.3/1.4	14.7/1.3
P. attenuatus		10.0/0.2		4.0/Tr			
P. confertus				2.6/0.4	2.6/0.2		
P. ellipticus	X				2.6/Tr		
P. eriantherus				X			
P. nitidus				2.6/Tr			
P. procerus				12.0/14.6		1.3/0.5	
Phacelia hastata				8.0/0.1	1.3/Tr	X	4.0/0.3
P. lyallii					X		
Phlox albomarginata						1.3/Tr	

Appendix 19 continued.

Forbs continued.	March	April	May	June	July	August	September
Physaria didymocarpa				X			
Polemonium pulcherrimum					2.6/0.4		
Polygonum bistortoides						16.0/0.2	
Potentilla sp.							6.7/0.7
P. arguta		1.7/Tr		1.3/0.2			2.7/0.4
P. diversifolia				1.3/Tr	8.0/0.2	4.0/Tr	
P. gracilis	1.3/Tr		5.3/Tr	5.3/Tr		4.0/0.2	4.0/0.4
P. ovina			1.3/Tr	X	9.3/0.2		4.0/0.2
P. uniflora	X						
* *Ranunculus eschscholtzii*					44.0/3.2	6.7/0.6	
R. glaberrimus					5.3/0.1		
* *Saussurea densa*						X	
Saxifraga sp.			5.3/Tr				
S. bronchialis	1.3/Tr			1.3/Tr	4.0/0.4	16.0/1.6	16.0/1.7
S. oppositifolia	1.3/Tr					8.0/0.1	
S. rhomboidea	1.3/Tr		1.3/Tr		6.7/0.1		
Sedum lanceolatum	5.3/Tr	13.3/Tr	48.0/0.3	49.3/1.3	38.6/0.7	14.7/0.3	13.3/0.3
S. roseum	2.7/Tr						
Senecio sp.				2.6/Tr			4.0/0.4
S. canus		18.3/0.2	6.7/Tr		1.3/0.2	1.3/0.2	2.6/Tr
S. integerrimus				2.6/Tr		1.3/0.2	
* *S. megacephalus*					1.3/Tr		1.3/0.2
S. pauperculus							5.3/0.8
S. resedifolius					8.0/0.3	1.3/Tr	
Sibbaldia procumbens		3.3/Tr					
* *Silene sp.*					2.6/0.5		
Smelowskia calycina	2.7/Tr				X	6.7/0.5	
* *Smilacena racemosa*				12.0/0.8			
Solidago sp.						8.0/0.7	
* *S. multiradiata*			16.0/0.1	16.0/0.4	21.3/2.8	18.6/2.0	34.7/3.4
* *S. spathulata*							9.3/1.2

Appendix 19continued.

Forbs continued.	March	April	May	June	July	August	September
Taraxacum officinale		1.7/Tr	2.7/Tr	2.6/Tr	5.3/0.3	1.3/Tr	9.3/0.4
Thalictrum occidentale			1.3/Tr	X	6.7/0.4	1.3/Tr	2.6/Tr
Townsendia parryi				4.0/Tr		4.0/Tr	1.3/0.2
* *Valeriana sitchensis*				1.3/Tr	6.7/0.2	X	
Veratrum viride					1.3/0.5		
* *Veronica cusickii*					18.7/0.4		
* *Viola sp.*		3.3/Tr	1.3/Tr				
* *V. adunca*				4.0/Tr		2.6/Tr	5.3/0.2
V. orbiculata				2.6/Tr		2.6/Tr	
Woodsia sp.						X	
Zygadenus sp.			2.6/Tr				
Unknown forbs	1.3/Tr		8.0/Tr	20.0/0.3	20.0/3.1	1.3/0.2	1.3/Tr
Grasses							
* *Agropyron sp.*		X	1.3/Tr				22.6/1.6
A. caninum						9.3/0.2	
* *A. spicatum*		36.7/2.2	12.0/Tr	6.7/0.1			8.0/0.9
* *A. trachycaulum*					4.0/0.7		
* *Bromus sp.*				1.3/Tr	9.3/0.5	8.0/0.2	13.3/1.2
B. carinatus					8.0/0.2	X	
B. ciliatus						6.7/0.3	
B. inermis							6.7/0.7
* *Calamagrostis purpurascens*	1.3/Tr					2.6/0.4	2.6/0.2
* *Carex sp.*	X	23.3/3.2	17.3/0.5	12.0/1.3	9.3/0.3	18.7/1.7	
C. rupestris	29.3/0.5						
Danthonia sp.							1.3/Tr
D. intermedia			18.7/0.7	1.3/Tr			1.2/1.3
* *Festuca idahoensis*				5.3/0.6	12.0/2.1		10.7/1.1
* *F. ovina*	29.3/1.3	28.3/1.1	5.3/Tr	38.7/2.6	18.7/2.4	4.0/Tr	42.7/5.7
* *F. scabrella*	1.3/Tr	X	20.0/4.3	48.0/7.9	4.0/0.3		

Appendix 19 continued.

Grasses continued.	March	April	May	June	July	August	September
* *Koeleria cristata*					2.6/Tr		
Luzula sp.					X		
Phleum alpinum					2.6/Tr		5.3/0.3
Poaceae	5.3/Tr						
* *Poa sp.*	X	6.7/Tr	26.7/0.4		50.6/3.1	2.6/Tr	X
* *P. alpina*					13.3/0.6	13.3/0.4	9.3/0.9
* *P. cusickii*			12.0/Tr	4.0/Tr	6.7/Tr	1.3/Tr	
* *P. fendleriana*				1.3/Tr			
* *P. interior*						2.6/0.2	12.0/0.8
* *P. sandbergii*			22.7/4.1			14.7/0.7	
Sitanion hystrix						1.3/Tr	
Stipa occidentalis							1.3/0.2
Trisetum sp.			1.3/Tr		1.3/Tr		6.7/0.4
T. spicatum	2.6/Tr				1.3/0.2	21.3/0.5	6.7/0.2
Unknown				1.3/Tr			
Unknown grass	4.0/Tr			13.3/0.1	25.3/0.9		1.3/0.2

1/ X = Occurred on the site but not in sample frames.
2/ Frequency (occurrence in 15-2X5 dm frames)/average cover (average of cover categories in 15 frames). Given in percent.
3/ * Plant had been grazed upon.
4/ Tr = Trace. Less than 0.1 percent.

Appendix 20. Plant species known to have been fed upon at mountain goat feeding sites.

	March	April	May	June	July	Aug	Sept
Trees							
Pinus albicaulis		X					
Pinus flexilis	X						
Shrubs							
Acerglabrum		X					
Arctostaphylos uva-ursi	X	X					
Berberis repens		X					
Juniperus communis	X						
J. horizontalis		X					
Rosa sp.		X					
Salix sp.			X				
Shepherdia canadensis	X	X					
Forbs							
Agoseris glauca				X	X	X	X
Anemone multifida							
A. parviflora						X	
Antennaria racemosa					X		
A. umbrinella					X		
Arnica sp.					X		
A. cordifolia						X	
Artemesia michauxiana							X
Aster alpigenus						X	
A. foliaceus				X		X	X
A. integrifolius					X		
A. occidentalis						X	
Astragalus bourgovii				X			
Bupleurum americanum			X				
Castellija sp.					X	X	
Castellijarhexifolia						X	X
Cerastium vulgatum						X	
Commandra umbellata				X			
Compositae				X			
Epilobium angustifolium					X		
Erigeron sp.							X
E. humilus				X			
E. pumilus			X				
Eriogonéum sp.				X			
E. umbellatum							X
Fragaria virginiana				X			
Gaillardia aristata						X	
Gentiana calycosa					X	X	
Haplopappus sp.				X			
Hedysarum sp.						X	
H. sulphurescens					X		

Appendix 20 continued.

	March	April	May	June	July	Aug	Sept
Forbs							
Hieracium sp.					X		
Lomatium cous				X			
Oxytropis sericea				X			
Pedicularis contorta					X	X	X
Penstemon sp.	X						
Phacelia hastata						X	
Potentilla arguta				X			
Ranunculus eschscholtzii					X		
Saussurea densa						X	
Senecio megacephalus							X
Silene sp.					X		
Smilacena racemosa				X			
Solidago multiradiata						X	
S. spathulata							X
Townsendia parryi				X			
Valeriana sitchensis					X		
Veronica cusickii					X		
Viola sp.			X				
Unknown				X			
Grasses							
Agropyron sp.							X
A. spicatum		X		X			X
A. trachycaulum					X		
Bromus sp.						X	
B. ciliatus						X	
Calamagrostis purpurascens						X	
Festuca idahoensis				X	X		X
F. ovina				X			
F. scabrella	X			X	X		
Koeleria cristata					X		
Poa sp.			X				
P. alpina					X		
P. cusickii				X			
P. interior						X	X
P. sandbergii			X			X	
Trisetum sp.							X
T. spicatum						X	
Unknown				X			X

Appendix 21. Plant genera which occurred in monthly mountain goat fecal samples.

	March	April	May	June	July	Aug	Sept
Trees							
Abies	X					X	
Pinus	X	X	X	X	X	X	X
Populus	X	X					
Pseudotsuga	X	X	X		X		
Shrubs							
Berberis	X	X	X				
Juniperus	X	X	X	X	X	X	X
Potentilla			X			X	
Prunus		X					
Ribes		X	X		X		
Salix	X	X	X	X	X	X	X
Shepherdia	X	X	X	X	X	X	X
Unknown	X	X	X	X	X	X	X
Grasses							
Agropyron	X	X	X	X	X	X	X
Agrostis	X	X		X			X
Bromus	X	X	X	X	X	X	X
Calamagrostis			X	X		X	X
Carex	X	X	X	X	X	X	X
Danthonia				X			
Deschampsia					X	X	
Festuca	X	X	X	X	X	X	X
Phleum		X	X	X	X	X	X
Poa	X	X	X	X	X	X	X
Stipa				X	X	X	
Trisetum	X		X	X	X	X	X
Unknown	X	X	X	X	X	X	X
Forbs							
Achillea		X					
Androsace	X	X	X	X	X	X	X
Antennaria	X	X	X	X		X	X
Arenaria	X	X	X	X	X	X	X
Astragalus	X				X	X	X
Besseya						X	
Cruciferae	X				X		X
Douglasia	X	X	X	X	X	X	X
Dryas				X	X	X	X
Erigeron	X		X	X	X		X
Eriogonum	X		X			X	
Galium						X	X

Appendix 21 continued.

	March	April	May	June	July	Aug	Sept
Forbs							
Hedysarum					X	X	X
Hieracium					X	X	X
Lomatium					X		
Lupinus				X	X	X	X
Penstemon		X					X
Phacelia				X	X		
Phlox	X					X	X
Potentilla			X	X	X	X	X
Saxifraga		X	X				
Trifolium						X	X
Vicia					X	X	
Unknown	X	X	X	X	X	X	X
Unknown							
Root		x	x				

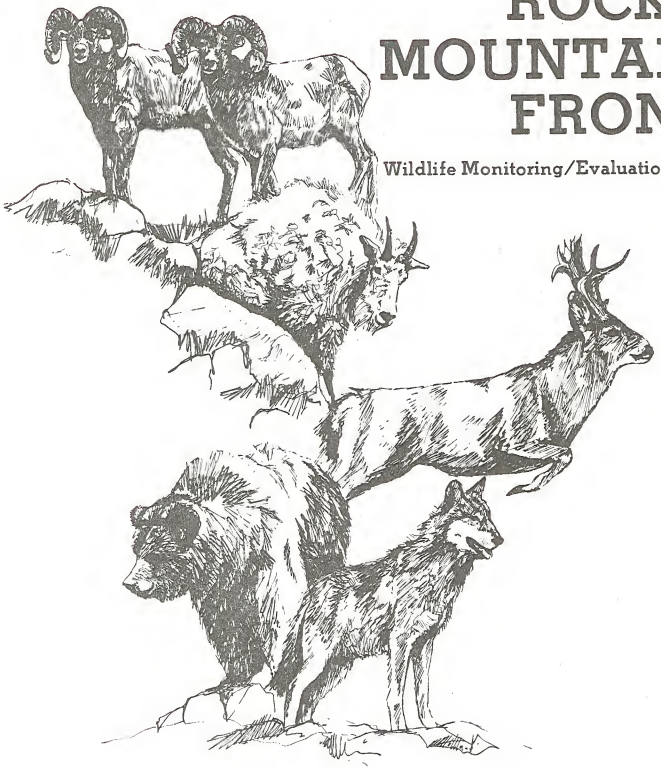
Appendix 22. Relative percent occurrence of the top 10 plant genera in monthly mountain goat fecal samples.

	March	April	May	June	July	August	September
1.	*Festuca* 17.2	*Festuca* 15.6	*Festuca* 12.8	*Festuca* 22.2	*Shepherdia* 15.2	*Astragalus* 14.8	*Shepherdia* 14.6
2.	*Juniperus* 11.6	*Berberis* 13.8	*Berberis* 12.4	*Poa* 11.8	*Astragalus* 14.0	*Androsace* 9.4	*Poa* 9.2
3.	*Pinus* 10.2	*Juniperus* 13.2	*Shepherdia* 11.6	*Shepherdia* 9.6	*Carex* 6.8	*Poa* 8.2	*Carex* 8.4
4.	*Arenaria* 8.8	*Poa* 6.8	*Juniperus* 8.4	*Agropyron* 7.8	*Arenaria* 6.8	*Carex* 7.4	*Astragalus* 7.6
5.	*Pseudotsuga* 8.2	*Carex* 6.4	*Poa* 6.8	*Androsace* 7.0	Unk. Forb 6.8	*Festuca* 7.4	*Androsace* 5.8
6.	*Carex* 6.6	Unk. Grass 5.0	*Agropyron* 6.4	Uncl. Grass 5.6	*Potentilla* 6.0	*Arenaria* 5.8	Unk. Forb 5.0
7.	*Androsace* 5.8	*Shepherdia* 4.8	*Pinus* 6.2	*Carex* 4.4	*Lupinus* 5.2	Unk. Forb 5.6	*Arenaria* 4.8
8.	Unk. Grass 4.8	*Androsace* 4.2	Unk. Browse 4.2	*Arenaria* 3.6	*Poa* 4.8	*Douglasia* 5.4	*Pinus* 4.6
9.	Unk. Browse 4.0	*Arenaria* 3.4	*Phleum* 3.8	*Douglasia* 3.6	*Douglasia* 4.6	*Bromus* 3.6	Unk. Grass 4.6
10.	Unk. Forb 4.0	Unk. Forb 3.4	Unk. Grass 3.6	*Lupinus* 3.2	*Festuca* 4.0	*Shepherdia* 3.4	*Bromus* 4.2

Interagency

ROCKY MOUNTAIN FRONT

Wildlife Monitoring/Evaluation Program



Management Guidelines for Selected Species,
Rocky Mountain Front Studies

Interagency Rocky Mountain Front
Wildlife Monitoring/Evaluation Program

Management Guidelines

Grizzly Bear	Elk
Mountain Goat	Mule Deer
Bighorn Sheep	Raptors

Approved by:

Dale Gorman — 4/2/84
John D. Gorman, Forest Supervisor — Date
Lewis and Clark National Forest

Glenn W Freeman — 4/6/84
Glem Freeman, District Manager, — Date
Bureau of Land Management, Lewistown District

Wayne H Brewster — 4-3-84
Wayne Brewster, Field Supervisor, — Date
U.S. Fish and Wildlife Service

Daniel Vincent — 4/5/84
Daniel Vincent, Regional Supervisor, — Date
Montana Department Fish, Wildlife and Parks

Introduction

The Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program was initiated in 1980. A principal goal of this program was to sponsor study efforts; whereby wildlife management guidelines, based on sound scientific findings, could be developed to aid land managers in their planning of human activities along the Rocky Mountain Front.

The original charter for this program specified that management guidelines were to be considered "interim" until five years of study had been incorporated into them. However, the guidelines developed thus far are currently being used as firm guidance by the involved agencies. Further, at the end of this five year period these guidelines should not be locked in concrete by the term "final". It is highly likely that studies will continue and additional findings will dictate new or revised guidelines. Therefore, these two terms will not be used and the management guideline development process and associated document are to be considered part of a dynamic planning process subject to periodic review and modification as additional study findings become available and as long as the need for them is present.

In the event that on-going monitoring results in the need for a new guideline or the modification of an existing guideline, it can be submitted at anytime by the procedures described and on the form given on the last two pages of this document.

The following management guidelines are based on the best information currently available. They are a result of current or recently completed studies on selected wildlife species. Field investigators conducting the studies have completed extensive literature reviews on the various species considered. The guidelines which have been formulated and presented in this document are not only the result of study findings and literature review, but incorporate the professional judgement of the technical personnel involved.

Objective

The need for management guidelines is predicated on management concerns involving the effects of existing and proposed land uses and human activities upon various wildlife species and their habitat. The objective of the development and application of management guidelines is to avoid or minimize the following effects of human related activities which may adversely impact some or all of the selected wildlife species being considered:

A. Physical destruction of important wildlife habitat components.
B. Human disturbance that would displace various wildlife species from important seasonal use areas.
C. Increased direct human caused mortality.
D. Increased stress due to higher human activity levels.
E. Direct mortality or physical impairment resulting from environmental (chemical) contaminates.
F. Increased wildlife/human interaction resulting from habitat intrusion or displacement.

Management Guidelines

Management guidelines provide coordination measures designed to avoid or minimize the potential conflicts previously identified between human related activities and wildlife. Although many of the guidelines are applicable to a variety of human activities, some of them are specific to a single activity. Oil and gas exploration and development has received special emphasis due to the relatively high level of activity in recent years. As a result, some of the guidelines apply specifically to that activity.

Approved management guidelines will be included in permits, contracts or other formal authorizations for human activities as applicable. Omissions or modifications of applicable guidelines in such authorizations will be documented in an EA report or other appropriate document concerning the activity involved.

Monitoring

A majority of the radio tracking and habitat survey data collected to date has been baseline information including the identification of seasonal ranges, reproduction areas, breeding areas and migration corridors. Future studies will place increasing emphasis on the monitoring of effects of increased human activity levels, particularly those associated with oil and gas exploration, on the wildlife species being studied. The management guidelines presented in this document are only partially based on monitoring information collected during the current studies on the Rocky Mountain Front. An important consideration in further monitoring efforts will be to test and validate the guidelines as to their effectiveness and applicability.

PART A. General Management Guidelines

The following general management guidelines are applicable coordination measures that will be considered when evaluating the effects of existing and proposed human activities in identified seasonally important habitats for a variety of wildlife species.

1. Identify and evaluate for each project proposal the cumulative effects of all activities, both existing uses and other planned projects. Potential site specific effects of the project being analyzed are a part of the cumulative effects evaluation which will apply to all lands within a designated biological unit. A biological unit is an area of land which is ecologically similar and includes all of the yearlong habitat requirements for a sub-population of one or more selected wildlife species.

2. Avoid human activities or combinations of activities on seasonally important wildlife habitats which may adversely impact the species or reduce the habitat effectiveness.

3. Space concurrently active seismographic lines at least nine (9) air miles apart to allow an undisturbed corridor into which wildlife can move when displaced. One line survey crew will be allowed to work between active lines in order to reduce the total time of activity in any one area.

4. Establish helicopter flight patterns of not more than one-half (1/2) mile in width along all seismographic lines, between landing zones and the lines, and between landing zones and other operations, unless flying conditions dictate deviations due to safety factors.

5. Because helicopters produce a more pronounced behavioral reaction by big game and raptors than do fixed-wing aircraft, helicopters will maintain a minimum altitude of 600 feet (183 meters) above ground level when flying between landing zones and work areas where landing zones are not located on seismic lines, unless species specific guidelines recommend otherwise (Hinman, H., 1974; McCourt, K.H., et al 1974; Klein, D.R., 1973; Miller, F.L. and A. Gunn, 1979).

6. Designate landing zones for helicopters in areas where helicopter traffic and associated human disturbances will have the minimum impact on wildlife populations. Adequate visual and/or topographic barriers should be located between landing zones and occupied seasonal use areas.

7. The use of helicopters instead of new road construction to accomplish energy exploration and development is encouraged.

8. Base road construction proposals on a completed transportation plan which considers important wildlife habitat components and seasonal use areas in relation to road location, construction period, road standards, seasons of heavy vehicle use, road management requirements, etc.

9. Use minimum road and site construction specifications based on projected transportation needs. Schedule construction times to avoid seasonal use periods for wildlife as designated in the species specific guidelines.

10. Locate roads, drill sites, landing zones, etc. to avoid important wildlife habitat components based on a site specific evaluation.

11. Insert "dog-legs" or visual barriers on pipelines and roads built through dense vegetative cover areas to prevent straight corridors exceeding one-forth (1/4) mile where vegetation has been removed (Stubbs, C.W. and B.J. Markham, 1979).

12. Roads which are not compatible with area management objectives and are no longer needed for the purpose for which they were built will be closed and reclaimed. Native plant species will be used whenever possible to provide proper watershed protection on disturbed areas. Wildlife forage and/or cover species will be utilized in rehabilitation projects where deemed appropriate.

13. Keep roads which are in use during oil and gas exploration and development activity closed to unauthorized use. Place locked gates and/or road guards at strategic locations to deter unauthorized use when activities are occurring on key seasonal ranges.

14. Impose seasonal closures and/or vehicle restrictions based on wildlife or other resource needs on roads which remain open.

15. Bus crews to and from drill sites to reduce activity levels on roads. Shift changes should be scheduled to avoid morning and evening wildlife feeding periods.

16. Keep noise levels at a minimum by muffling such things as engines, generators and energy production facilities.

17. Prohibit dogs during work periods.

18. Prohibit firearms during work periods or in vehicles traveling to and from work locations.

19. Seismographic and exploration companies should keep a daily log of activities. Items such as shift changes, shut down/start up times, major changes in noises or activity levels, and the location on the line where seismic crews are working should be recorded.

PART B: Species Specific Management Guidelines

The species specific management guidelines which follow provide coordination measures necessary to protect important habitats or seasonal use areas for several wildlife species which were selected for intensive baseline surveys on the Rocky Mountain Front Study Area. Monitoring of the effects of human activities on these species and their habitats will continue to receive special study emphasis.

Maps which delineate the seasonally important habitats for which timing restrictions are specified have not been included in the management guideline document and are not available for general distribution. Copies of these maps are available for inspection at the offices of the four Agencies involved in the Rocky Mountain Front Wildlife Monitoring Program.

These guidelines together with the "general management guidelines" will minimize, but not eliminate, the impacts of disturbances caused by human activities on these species. Species specific guidelines are currently available for grizzly bear, mountain goat, bighorn sheep, elk, mule deer and raptors.

Mountain Goat

The Montana Mountain Goat Investigations along the East Front of the Rocky Mountains, funded by the Montana Department of Fish, Wildife and Parks, the Lewis and Clark National Forest and the Allen Foundation, is the basis for formulating management guidelines (Thompson 1980; Tomasko 1980; Joslin 1984, 1983, 1982, 1981). Literature concerning wildlife (primarily mountain goats) and land use conflicts was also used in developing some of the guidelines.

The guidelines are heavily oriented toward disturbance related to oil and gas activity since that is the primary activity of concern now, however, other activities which may influence mountain goats are also addressed. The following guidelines are based on historic information from this area and data collected duirng the last four years. These guidelines represent the best information now available.

All previously mentioned "general management guidelines" are coordination measures that should be considered when evaluating human activities in mountain goat habitat. The following is adapted from the mountain goat investigations annual report (Joslin, 1984) and provides species specific guidelines which are applicable to a variety of human activities.

1. Avoid human activities in identified mountain goat habitat during the following seasonal use periods:

   A. Occupied yearlong mountain goat habitat
      1) Kidding - nursery areas ---------- May 1 - July 15
      2) Breeding areas ---------- November 1 - December 31
      3) Winter range ---------- October 15 - May 15

   B. Suitable low occupancy mountain goat habitat
      (Appropriate surveys of suitable mountain goat habitat will be made by a wildlife biologist to determine whether goats are present prior to initiation of a planned activity. If goat use is documented, the stratification will be changed to occupied yearlong mountain goat habitat and the listed guidelines will apply. If mountain goat use is not documented, then guidelines listed for transitional areas will apply).

   C. Transitional mountain goat habitat
      (The area between occupied yearlong habitat through which mountain goats travel. Timing restrictions apply to exploratory drilling, road construction and maintenance, timber harvest, off-road and trail vehicle travel, and any other mechanized activity which extends beyond one week in duration).

      ---------- October 15 - December 31
      and
      May 1 - June 30

2. Mineral licks used by mountain goats should have a no surface occupancy stipulation for a one-mile radius around the site (Joslin, 1984).

3. New mineral licks within mountain goat habitat should not be established without considering the safety of goats (Rideout, 1974).

4. Establish helicopter flight patterns at least one mile from mountain goat mineral licks during the May 1 - July 31 period (Joslin, 1984).

5. Restrict use of roads and trails which cross or come to within one-half mile of a mountain goat mineral lick to nonmotorized use during the May 1 - July 31 period.

6. Avoid constructing wells, pipelines or roads within 1 mile of occupied yearlong habitat.

7. Establish flight patterns in advance when activities require the use of helicopters. Flight patterns should be located to avoid seasonally important mountain goat habitat during the use periods designated above.

8. Exploratory well drilling should not occur within occupied habitat. Exploratory drilling on adjacent sites within Suitable and/or Transitional mountain goat habitat should be staggered to provide a disturbance-free area for displaced mountain goats.

9. Livestock use of mineral licks used by mountain goats should occur after July 1 or pasture use staggered so that adjacent licks are not used simultaneously by livestock.

10. In occupied yearlong habitat, livestock grazing should be restricted to the period July 1 - October 15.

11. The level of livestock use in occupied habitat should not be increased, and grazing of domestic sheep should not occur.

12. No suppression of insects and disease should occur in occupied habitat unless adjacent resource values are threatened.

13. Timber harvest and road construction within occupied mountain goat habitat should be closely coordinated with the Montana Department of Fish, Wildlife and Parks to address the needs of mountain goats.

Montana Department of Fish, Wildlife & Parks

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